Welding Engineer

June, 1960
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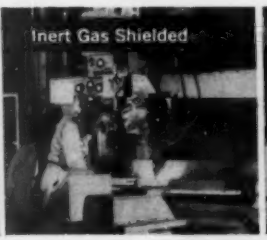

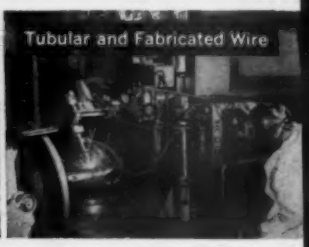

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VOL. 45—No. 6

Welding Engineer

The magazine of joining and severing of materials

This is welding: June, 1960

Cover photo . . . Magnetic particle testing of welded thrust chambers for missile engines using equipment from Magnaflux Corp. See page. 44.

N D T

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To insure product quality from the designer's table to final shipping, there are numerous controls and inspections — and one of the most important is non-destructive testing.

Radiation source selection depends on your needs 32
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Profitable dealerships open; inquire now!

VICTOR EQUIPMENT COMPANY *Alloy Rod & Metal Division* H-65

13808 E. Imperial Highway, Norwalk, California . . . . Wakita, Oklahoma

ONE of the last welds is made on water tower for Schererville, Ind. City tower, constructed by Graver Tank & Mfg. Co., is said to be first built from the top down.

NEWS

R. D. Thomas Jr. of Arcos Corp. is new president of AWS

R. D. Thomas, Jr., president of Arcos Corp., Philadelphia, was elected president of the American Welding Society at the organization's 41st annual convention in Los Angeles April 25-29.

Thomas, an active member of AWS for many years, will take office June 1. A recipient of the 1958 Miller Medal, he is a past chairman of the Philadelphia section and has served as chairman of many important AWS technical committees.

Other officers chosen during the convention were: A. F. Chouinard, director of research and development, National Cylinder Gas, re-elected vice-president; J. H. Blankenbuehler, design engineer, Hobart Bros. Co., vice president; Clarence E. Jackson, associate manager of electric welding development, Linde Co., vice president.

Elected district directors of the society were: James M. Shilstone, southeast district; David P. O'Connor, western district; George W. Kirkley, New England district; and Lester L. Baugh, west central district.

Chosen as directors-at-large were: Dr. Robert D. Stout, Lehigh University; John Mikulak, Worthington Corp.; Roy McCauley, Ohio State University; and Dr. Ernest F. Nippes, Rensselaer Polytechnic Institute. (See story on p. 56)

Radioisotope courses scheduled at U. of Calif.

The University of California at Berkeley, Calif. — in cooperation with the U. S. Atomic Energy Commission—will sponsor a series of courses on radioisotope principles and techniques for management and technical personnel during June and July.

A one-week survey course will take place July 18-22, to increase understanding in basic concepts of radioisotope and radiation technology.

From June 6 to 17, an intensive theory application course will be held, designed to give a broad insight into the potentialities and problems of using radiation in industry and research. Major emphasis will be placed on handling. Another course will be given from June 20-July 15.

French firm to make Ransome products

Ransome Co., Scotch Plains, N. J., has concluded an agreement to have its standard line of positioners, turning rolls, welding head manipulators, and other products manufactured in France.

The firm recently arranged to have Petro-Fouga Co.. Paris, begin production on the line. Petro-Fouga is a major manufacturer of heavy boiler and pressure vessels, well drilling equipment, and transportation equipment.

MASKING tape is run through air diffuser, component of a gas turbine engine, to demonstrate difficulty of cleaning the part. Many of the inside surfaces cannot be reached by means other than ultrasonic pickling. Even so, some parts make up to a half a dozen trips through the tank, since parts are cleaned individually after they are welded in position. (Photo courtesy Branson Ultrasonic Corp.)

Black & Decker sales top last year's

Sales of power tool products of Black & Decker Mfg. Co., Towson, Md., continue to break previous records, according to an interim stockholders report.

The company reported that in the six months ending March 27, net sales totaled $28,763,487, which was 18.5% greater than the same period of last year and the highest for any similar period in the firm's history.

L & B products will be marketed by Victor

Products of L & B Welding, Inc., Berkely, Calif., recently acquired by Victor Equipment Co., San Francisco, will be marketed under the Victor name through Victor dealers in the U. S., Canada, and the export field.

The line includes track roller and idler rebuilding machines, automatic rebuilders of track links, grouser bar welders, roller and idler assembly and disassembly presses, pantographs, flux grinders, roller flange hardenders, and roller and idler grinders.

ALLOY steel elbow is believed to have the heaviest walls ever forged in a pipe fitting its diameter. The walls, 4 1/3-in. thick, are made to contain superheated steam at more than 1,000 F and a pressure of 2,000 psi. Employee at Tube Turns Div., Chemetron Corp., Louisville, checks the 9 1/3-in. inner diameter.

COMING EVENTS

SEPT. 26-29: Fall Meeting, American Welding Society, Penn-Sheraton Hotel, Pittsburgh.

OCT. 13-15: AWS Western Welding Show, Exposition Hall, Santa Clara County Fair Ground, San Jose, Calif.

OCT. 17-21: 48th Annual Safety Congress, Chicago; 1960 Philadelphia Metal Show, Trade and Convention Center, Philadelphia.

DEC. 5-8: 1st Biennial Short Course on Welding Engineering, University of Illinois, Urbana, Ill.

Samarium-153 producing x-ray quality radiograms

Samarium-153—a low energy, short-lived radioisotope first introduced as a means to radiograph thin aluminum and steel sections—is experimentally producing medical radiograms of quality equal to x-rays.

The advance was achieved at the research laboratories of General Motors Corp., Detroit. Last year, working primarily on industrial radiography of aluminum and steel castings, the GM research physics department began applying the isotope to medical specimens.

With the new technique, x-rays can be used where operation of an x-ray machine would be impossible—in the field, in emergency or disaster situations, remote areas, etc.

Samarium-153 needs only a lightweight source container. It has a two-day half-life but can be used effectively for a week or two and then reactivated.

(Additional news on p. 78)

Metronics, Inc. formed as alloy rod producer

Metronics, Inc., Englewood, N.J., was recently established as a mass producer of tungsten and molybdenum rod, wire, and electrodes, as well as tantalum and columbium rod and wire, and a variety of special alloys.

The firm was formed as the result of a study which indicated an unfilled need for specialized metallurgical products and facilities to serve the requirements of the automotive, electrical, electronic, aircraft, missile, and metal-working industries.

Officers of the new company include: Michael J. Nelson, president; Robert V. Gensheimer, vice president; Patrick K. Hynes, vice president; and William O. Touhey, secretary-treasurer.

Industrial radiography course offered

A course in industrial isotope radiography will be given by the nondestructive testing department of Curtiss-Wright Corp., Princeton, N. J., from June 6-10.

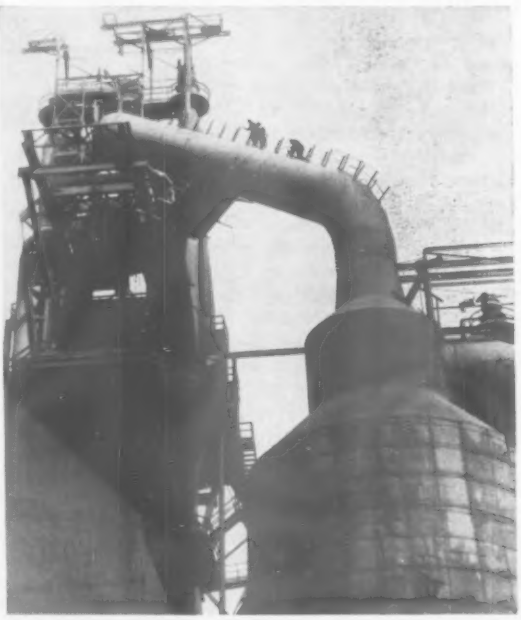
Subjects under consideration will be source selection, darkroom techniques, and instrumentation. The newest developments in shop and field testing equipment, including using Cobalt 60 and Iriduim 192, will be used as teaching aids.

The course, set up to enable students to meet AEC licensing requirements, has been given five times during 1958-1959.

Budd gets half of U. S. Cobalt-60 shipments

More than half of all Cobalt-60 isotopes shipped by the U. S. Atomic Energy Commission in 1959 were purchased by the Instruments Division of Budd Co., Philadelphia.

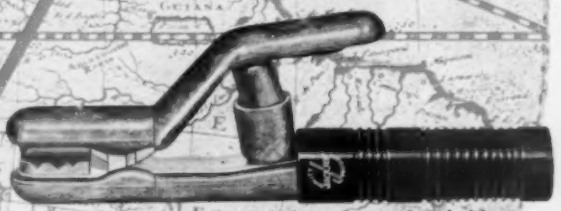
Of some 169,000 curies of cobalt, Budd acquired more than 89,000. The isotope is encapsulated by the company for a variety of purposes, including use as sources in radiography machines which can penetrate up to 12 in. of steel for casting or weldment flaw detection.



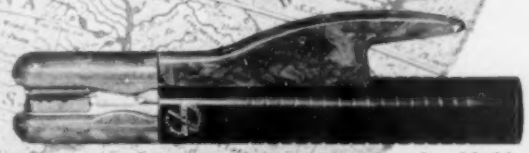
WORKERS weld giant downcomer at Chicago South Works of U. S. Steel Corp. Vessel, which removes combustible gas from blast furnace, was purged with 48,000 lb of CO_2 by Cardox Div., Chemetron Corp., Chicago.

Jackson *Featherlight* Holders

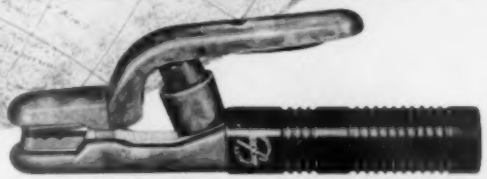
Lighten the welder's load—speed his work. Jackson aluminum-alloy electrode holders weigh up to 35% less, provide durable copper-alloy jaw inserts, and superior long lasting insulators. A Jackson pioneered product — proven good, throughout the world. Select your general duty holders from this Featherlight line.



Jackson Model A-5S, *lightest large-class holder.* Capacity: 5/16" rods at 400 amps. (weighs only 21 oz.)



Jackson Model JH-3, *medium-class streamlined holder.* Capacity: 1/4" rods at 300 amps. (weighs only 15¾ oz.)



Jackson Model A-W, *lightest medium-class holder.* Capacity: 1/4" rods at 300 amps. (weighs only 14 oz.)

Jackson Model JH-2, *small-class streamlined holder.* Capacity: 5/32" rods at 200 amps. (weighs only 9½ oz.)

Sold by better welding supply distributors and dealers everywhere

Jackson Products

AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

31739 Mound Road, Warren, Michigan

Al Earlbeck found a safe, fast

The sheet steel bodies of truck trailers can be murderous when you have to cut through them to do repair or special installation work. Cutting with metal saws produces edges as jagged and mean as shark teeth.

At Baltimore's Warner Fruehauf Trailer Company, distributor of Fruehauf Trailers, they tried using abrasive wheels to remove the jags but the job tore ordinary wheels to pieces so it had to be done by hand with files. And that was both slow and dangerous work for the man behind the file.

Then came Bay State distributor Al Earlbeck of Earlbeck Welding Supplies, Inc. He introduced Bay State's reinforced raised hub disc wheels and the results were astonishing. Not only did the Bay State wheels stand up to the work of grinding down jagged sheet metal edges, they even outperformed saws when it came to cutting the tough, thin, corrugated, stainless steel panels. Furthermore, they did an outstanding job of grinding down spot welds on chassis assemblies and other trailer components. Wheel-loading became a thing of the past and the Bay State wheels wore down so evenly they could be used almost down to the center hub.

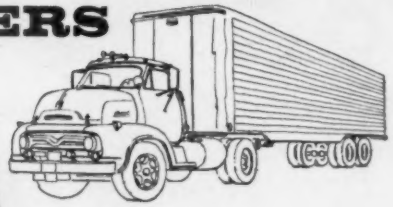
As Warner Fruehauf Shop Foreman Melvin Wengert says, now that he's been using the Bay State wheels for some time . . . "you can't beat 'em for safety and versatility. They do the job better than any other method and any other wheel . . . and that's that." Wengert, incidentally, is a man with some 20 years experience in welding and general metal-working problems.

Like Al Earlbeck, your own Bay State distributor or direct representative has both the products and the specialized knowledge that enable him to improve any grinding operation that *can* be improved. Why not turn him loose on yours and see what he comes up with? *Better grinding at lower cost . . . that is his business.*

(Left) Warner Fruehauf Shop Foreman Mel Wengert checks weld bead with Al and Tom Earlbeck after weld had been ground with the same wheel that was used to smooth sheet metal edges of aperture cut in trailer body.

(Below) Operator Jerry Clark trims stainless steel burrs from opening made for installation of refrigeration unit.

answer to grinding the "shark's teeth" on TRUCK-TRAILERS



Al Earlbeck has 25 years of practical experience in grinding problems and has also taken just about every course there is in welding technology . . . starting at Baltimore Polytechnic Institute and winding up with advanced courses at Johns Hopkins. His son, Tom, is currently going through the same tough schedule of technological training. Meanwhile, Al himself sponsors courses and serves as executive of many technical associations as well as running Earlbeck Welding Supplies, Inc. He has tried other competitive grinding wheel lines but dropped them because he always found Bay State superior in both quality and service.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
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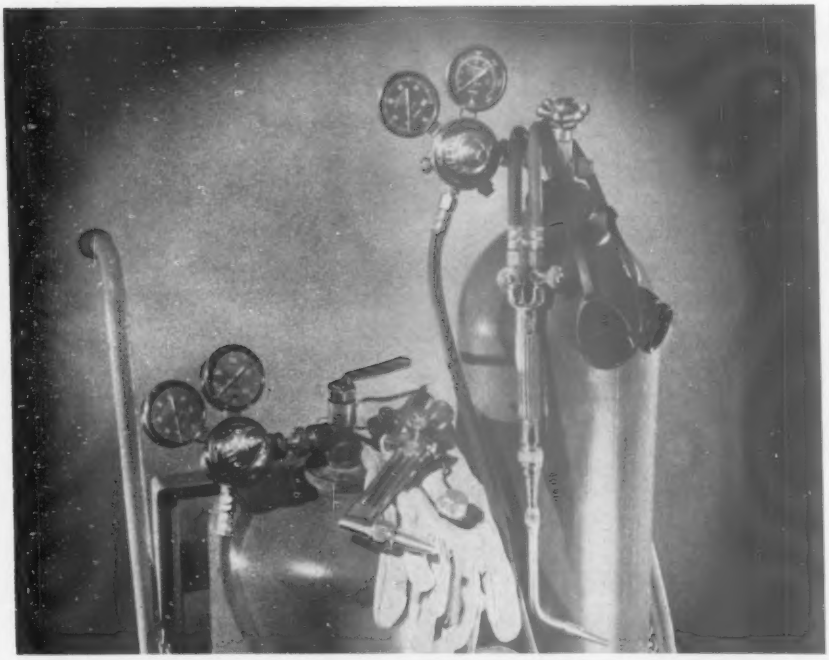

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WELDING ENGINEER

Your June, 1960 *Weld World*

As WE went to press, these were the industry's latest developments:

. . Spot survey of manufacturers exhibiting at welding show indicated business in first quarter of this year was good, though April slowed a bit. However, 1960 still looks like another record breaker . . . at this time.

. . Some steel prices went down last month. Reinforcing bars were costing users about $8.50 less per ton. Reason: intense foreign competition. Some specialized steels, used in missile and rocket parts, also were reduced. Mills said savings were realized through experience gained in production.

. . Air Force plans to purchase 70 liquid-oxygen production plants have met with opposition from private industry. At recent Congressional hearing, T. M. Kean, president of Independent Oxygen Manufacturers' Association, and eight other members of industry, voiced their protests. Two points: Air Force move would cause harmful economic effects on private firms, and Government competition with private industry is contrary to announced policy.

. . A West Coast facility has been acquired by Bay State Abrasive Products Co. with the purchase of Felker Mfg. Co., Torrance, Calif. The Westboro, Mass., manufacturer will operate Felker, which makes diamond abrasive cutting wheels and cut-off machines, as a wholly owned subsidiary under direction of Vice President Elden L. Auker.

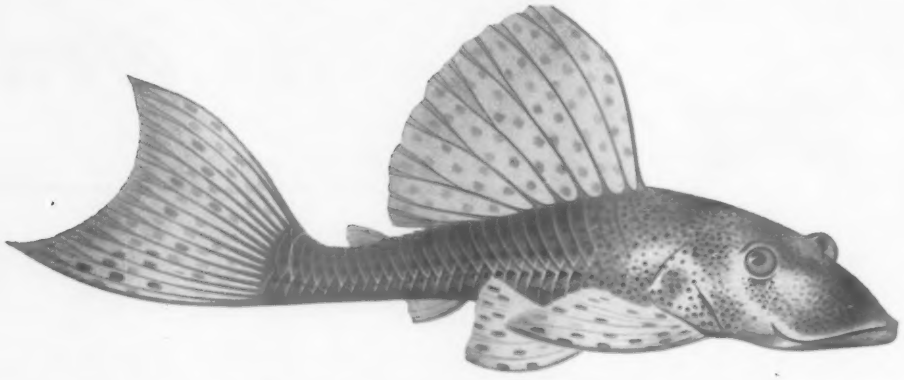
. . Attendance at Chicago convention of National Welding Supply Association last month fell just four short of record high of 759 established several years ago in New Orleans. V. B. Anderson was elected president, succeeding A. C. Axtell.

. . NWSA has voted a $10,000 appropriation to produce a film promoting welding, which will be made at Ohio State University. The organization has also donated $1,000 to the AWS fund for the United Engineering Center.

. . DeWalt, Inc., Lancaster, Pa., a wholly owned subsidiary of American Machine & Foundry Co., has been sold to Black & Decker Mfg. Co., Towson, Md., for 120,000 shares of the latter's stock. DeWalt makes industrial radial saws as well as saws for home workshops.

. . In commemorating its 75th anniversary, Norton Co., Worcester, Mass., recently held a series of open house days, preceded by an editors' day. Primary purpose was to show off its new plant for manufacture of organic bonded grinding wheels.

To identify a strange fish...



you call in an *ICHTHYOLOGIST*

(specialist in fish life)

to cut production costs...

you call in *LINCOLN*

(specialists in arc welding)

BECAUSE of high operating costs a Maryland barge builder had trouble meeting competitive prices. The LINCOLN Field Engineer recommended a semi-automatic "Squirt" welder. On heavy plate it was four times faster and reduced overall costs due to reduced plate preparation and cleaning time.

As a matter of fact, right there is a good reason for doing business with LINCOLN. Cost reduction is a sort of religion at LINCOLN where production costs have dropped as much as 50% in the last 20 years. It's the result of LINCOLN'S world-famous cooperation between employees and management where everybody gets paid according to his own contribution to the company's goal—superior products and service to you at continually decreasing costs.

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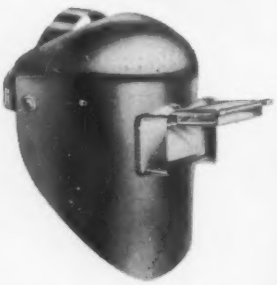
VULCANIZED FIBRE WELDING HELMETS



460-4-C – Straight front for extra chest and throat protection; with Inner Bib for added light and fume seal; seamless; lift-front glassholder.

666-P9 – Fabricated with flat sides, narrow, compact (preferred by Western weldors); light and comfortable; leakproofed seams; 668-P9 has lift-front glassholder.

270-4-C – Seamless; curved bottom to exclude fumes and light; comfortable free-floating headgear with Ratchet adjustment; fixed-front glassholder.

Inner Bib – Straight front shells give increased neck and chest protection. Available with this Inner Bib for added light and fume seal!

Noted for comfort and safety, these FIBRE-METAL Helmets are formed and fabricated from finest quality, full gauge vulcanized fibre. They "seal" the weldor against light leakage and afford fullest ventilation.

All helmets have Ratchet Adjustment *"free floating"* Headgear, impact resistant adjustable friction joints and adjustable chin rest. Glassholders are available in plastic, steel or Dowmetal, in either fixed-front or lift-front styles.

All types and models of FIBRE-METAL Welding Helmets are described in Catalog No. 26. **Ask your Welding & Safety Distributor!**

The FIBRE-METAL Products Company | CHESTER PENNA.

In CANADA: Fibre-Metal (Canada) Limited, Toronto

Letters . . .

Defends distributor

(The following letter sent to WE was addressed to Bela Ronay, frequent contributor to this magazine.)

Mr. Bela Ronay *Baltimore*

First, I consider you a friend, Bela, who has faithfully served the American Welding Society Maryland section as an officer, and I take great pride in having been associated with you in organizing and teaching welding metallurgy to our local AWS members.

I also respect your right to your own opinion but I feel your thoughts in the final few paragraphs of your article "Do you have a true picture of your fabrication costs?" were grossly unfair to the majority of America's welding distributors and manufacturers.

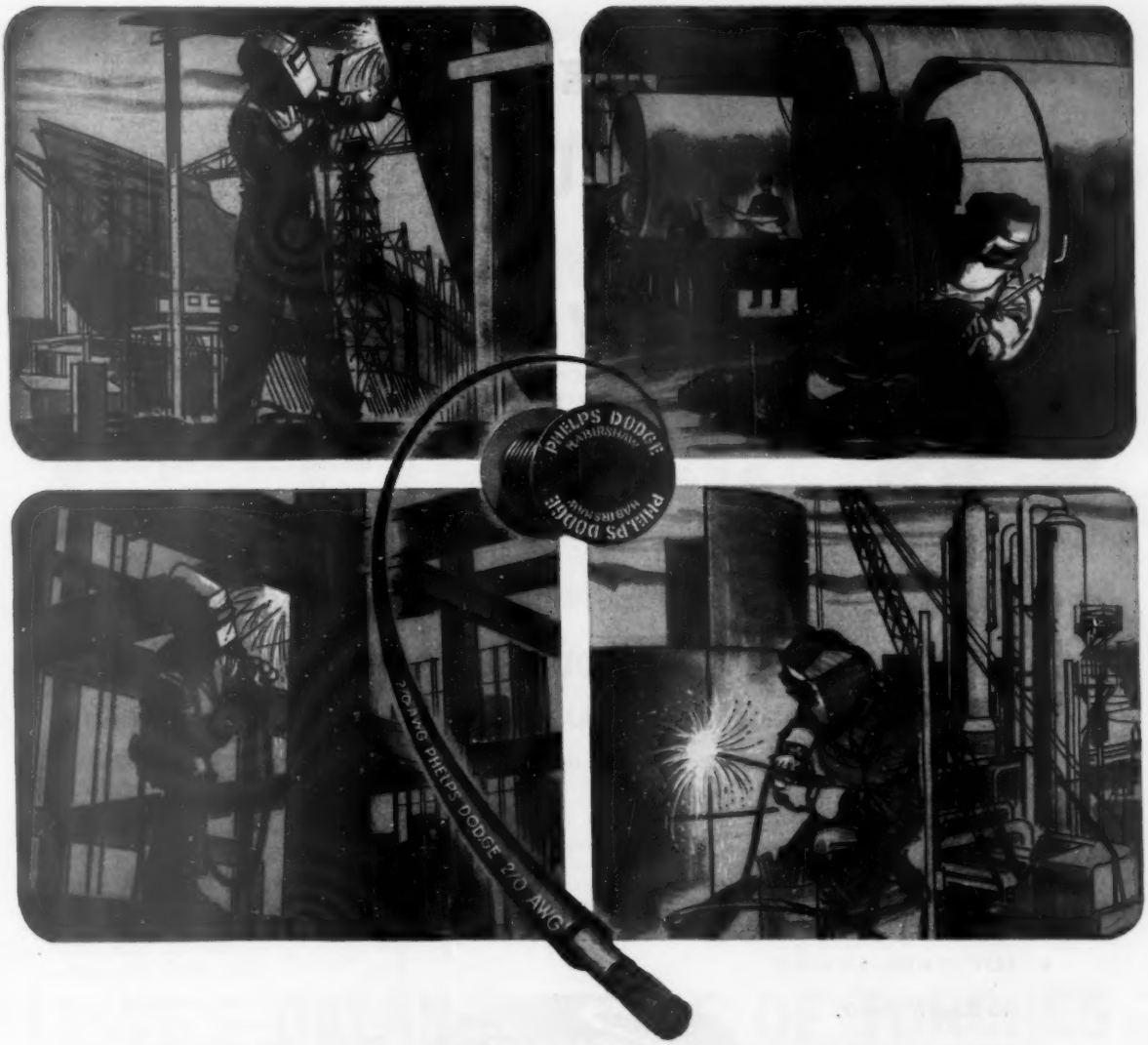
Most of us have had many years of experience (this is my 25th year) diagnosing welding troubles and prescribing different procedures, techniques, or even a whole new process in order to cut those admittedly high costs per foot of welded joint.

We are *not* just skilled in the art of welding (as you infer by saying we should confine ourselves to only demonstrating processes) but, my technicians and most of my fellow NWSA distributors and manufacturers are also equally well experienced in the science of welding.

You have mentioned to me several times since you became a consultant a few years back that the local Baltimore area fabricators don't have many problems. Bela, don't you believe it!

Just call on a few of Earlbeck Welding Supplies' customers for an unbiased testimonial as to how skillfully and honestly my technicians and myself solve their problems almost every working day. This applies not only to the large fabricator who can afford your services but more importantly to the small and medium size fabricator who needs our help the very hour he calls on us. Usually our sole intent is to help reduce the cost of the weldment or to outline a sound procedure, and more often than not a sale does *not* result.

As you know, we have just completed our third welding metallurgy course in the last six years, again instructed by George E. Linnert and sponsored by us so that more of our customers may in the future



Phelps Dodge Habirprene* Arc Welding Cable
lasts longer under roughest working conditions!

The durable quality of Phelps Dodge Habirprene arc welding cable makes it ideal for use on jobs where welding cable undergoes severe physical wear and tear. Records show that Habirprene cable more readily absorbs heavy blows and weights, resists oxidation and damage caused by severe working conditions in shipyards, oil refineries, building construction and boiler-making plants. In some applications, Habirprene cable has lasted many times longer than rubber cable.

More than 10 years ago, Phelps Dodge pioneered Habirprene welding cable—the first real advance in this field. Today's Habirprene welding cable is the result of Phelps Dodge development and manufacturing experience devoted over the years to providing an arc welding cable of superior quality with a proven record for safety, dependability and long life. This cable meets all requirements of A.S.T.M. D752.

See your authorized Phelps Dodge distributor for hard-wearing, long-lasting Habirprene arc welding cable with indelible gold markings. Phelps Dodge also makes a full line of rubber arc welding cable and welding power supply cable. All these cables are available from stock.

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solve many of their problems without calling either you or me.

We take great pride in being family-doctor type practitioners who know exactly how much "therapy" and "medication" to prescribe before our customer should consult a welding technologist like yourself on their occasional highly complex problem.

A. C. Earlbeck
Earlbeck Welding Supplies, Inc.

Oversight?

Sir: *Columbus, Ohio*

I had an opportunity to read the article by Mr. Ronay and was proceeding to enjoy his article, commenting upon his desire for a breadth in engineering work, hoping for a kind word from the author indicating that only one university in the country is doing what he suggests; namely, Ohio State University.

We were almost flabbergasted to note that Mr. Ronay indicates that no engineering curricula is doing this job! I am quite sure that Mr. Ronay as well as the editor of WE is well aware of Ohio State University and if the article is considered to be a criticism, we would certainly like to hear this subject carried forth at length.

We hope this was an oversight, but after being challenged by a good number of people, feel that we should at least ask for a clarification of this statement.

Roy B. McCauley
Ohio State University

(The author was speaking about the great majority of engineering schools throughout the United States. Ohio State and maybe two or three other schools are exceptions that prove the rule.—Ed.)

Oxygen unit

Sir: *Altoona, Pa.*

In WE, March 1960, page 15, paragraph 5, the article about "AerOxy-Gen," made by Aerojet-General Corp., interests us. Please furnish us with the address of Aerojet-General Corp.

Raymond H. Paul

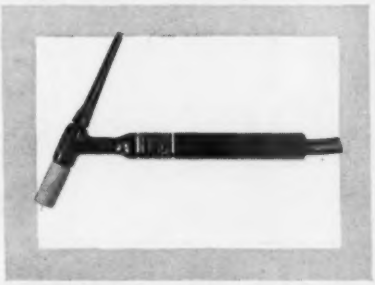
(Yours is just one of many letters which were prompted by the announcement of Aerojet-General's device. Despite the fact that the news release implied the unit was ready to be marketed, we were told by the firm that it is not quite ready for distribution. However, if you wish to write, direct your inquiry to Aerojet-General Corp., Box 296, Azusa, Calif.—Ed.)

HW-9 110 amp., Air cooled. Weighs only 3 oz. Interchangeable collet body and torch cap provide 120° or 60° working angles for torch head. Screw-on connections for cable and hoses. AC or DC. Self-aligning electrodes. Electrode sizes: .020 to 1/16 in.

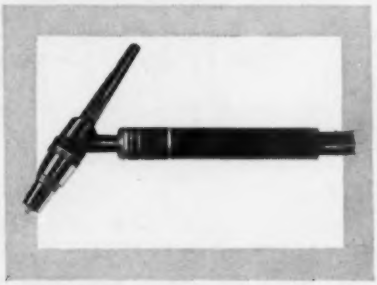
HW-9 110 amp. Pencil torch. Air cooled. For welding thin gauge materials. In-line design for welding in hard-to-reach joints. Handle is high impact phenolic tube over bronze torch body. AC or DC. Self-aligning electrodes. Electrode sizes: .020 to 1/16 in.

HW-17 130 amps. AC or DC. Highest rated air cooled manual torch available. Self-aligning electrodes. Design eliminates high-frequency leaks. Collets, collet bodies, caps and cups interchangeable with HW-18. Electrode sizes: .020 to 3/32 in.

HW-20 200 amps. AC or DC. Water cooled. Weighs only 3.3 oz. This small-size torch can actually weld inside a 3-in. tube. No chance of water leaks (same design as HW-18). Self-aligning electrodes. Electrode sizes: .020 through 1/8 in.



HW-18 300 amps. AC or DC. Water cooled. Torch body is molded around water passages to form closed cooling system—no chance of leakage. Improved collet bodies for better shielding with less gas. Torch designed for welding metals with a wide range of thicknesses. Self-aligning electrodes. Electrode sizes: .020 to 1/8 in.



HW-12 500 amps. AC or DC. Water cooled. For heavy-duty manual welding. Includes two collet bodies, one from 10 to 300 amps., the other, 300 to 500. Straight-line water passages are easily cleaned. Entire torch quickly disassembled. Electrode sizes: .040 through 1/4 in.

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ASK YOUR LINDE DISTRIBUTOR or write Dept. WE-06 Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

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HANDY & HARMAN SILVER BRAZING ALLOYS

NAME	COMPOSITION PERCENTAGE Ag	Cu	Zn	Other	MELTING POINT °F	°C	FLOW POINT °F	°C	TROY OUNCES PER CU. IN.
EASY-FLO	50	15½	16½	(18 Cd)	1160	625	1175	635	5.0
EASY-FLO 3	50	15½	15½	(16 Cd-3 Ni)	1170	630	1270	690	5.0
EASY-FLO 45	45	15	16	(24 Cd)	1125	605	1145	620	4.9
EASY-FLO 35	35	26	21	(18 Cd)	1125	605	1295	700	4.9
SIL-FOS	15	80		(5 P)	1185	640	1300	705	4.5
SIL-FOS 5	5	88¾		(6¼ P)	1185	640	1300	705	4.4
TEC*	5			(95 Cd)	640	340	740	395	4.6
TEC-Z*	5		16.6	(78.4 Cd)	480	250	600	315	4.5
BRAZE 071 (SN #7)†	7	85		(8 Sn)	1225	665	1805	985	4.8
" TL	9	53	38		1410	765	1565	850	4.5
" ATT	20	45	30	(5 Cd)	1140	615	1500	815	4.6
" 202 (AT SPEC)†	20	45	35		1315	715	1500	815	4.7
" NE	25	52½	22½		1250	675	1575	855	4.7
" 251 (AE)†	25	57½	17½		1270	690	1625	885	4.7
" NT	30	38	32		1250	675	1410	765	4.7
" DT	40	36	24		1235	670	1415	770	4.8
" SS	40	30	28	(2 Ni)	1220	660	1435	780	4.8
" 404 (SS-5)†	40	30	25	(5 Ni)	1220	660	1580	860	4.7
" DE	45	30	25		1225	665	1370	745	4.8
" ETX	50	34	16		1250	675	1425	775	5.0
" 541 (4772)†	54	40	5	(1 Ni)	1340	725	1575	855	5.1
" 560 (ER)†	56	22	17	(5 Sn)	1145	620	1205	650	5.0
" 580 (EB)†	57½	32½		(7 Sn-3 Mn)	1120	605	1345	730	5.1
" RT	60	25	15		1245	675	1325	720	5.0
" 603 (RT-SN)†	60	30		(10 Sn)	1115	600	1325	720	5.2
" 630 (RSNI)†	63	28½		(6 Sn-2½ Ni)	1275	690	1475	800	5.1
" EASY	65	20	15		1240	670	1325	720	5.1
" 655 (RE-MN)†	65	28		(5 Mn-2 Ni)	1385	750	1560	850	5.2
" MEDIUM	70	20	10		1275	690	1360	740	5.1
" BT	72	28			1435	780	1435	780	5.2
" HARD	75	22	3		1365	740	1450	790	5.3
" 752 (TR #1)†	75		25		1300	705	1330	720	5.1
" IT	80	16	4		1340	725	1490	810	5.3
" 852 (85 Ag-15 Mn)†	85			(15 Mn)	1760	960	1780	970	5.1
PREMABRAZE 610	61	24		(15 In)	1155	625	1305	705	5.0

*A Solder – Not a Brazing Alloy. †Former Names

Space does not permit listing the many special alloys, formulated for a particular or unique application. Handy & Harman Brazing Engineers and Technical Service are always ready to work closely with you on metal joining problems and methods.

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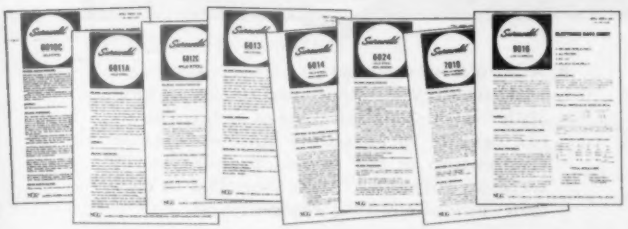
No matter what the job, there's a Sureweld Electrode to do it better. Want slow burn off rate to fast bead deposition rate with maximum penetration? Want slow and cool deposition with minimum penetration? Want special alloying or shielding characteristics? Whatever you want, you can get it in Sureweld Electrodes.



NEW . . . Sureweld Electrode Data Sheets. Complete and detailed information on each electrode . . . welding characteristics, welding procedures, color identifications, physical properties of deposited metal, recommended current ranges per stock sizes, etc. Just write today outlining the applications in which you are interested and we will be happy to forward data sheets to meet your needs. There is no obligation.

NEW . . . A completely re-designed package. All Sureweld Electrodes are now packaged in this handsome, strong, moisture-resistant carton providing maximum protection. In addition, for your convenience, easy access has been provided. With a simple pull of the "Zipper", about one-third of the carton comes away, and the electrodes are instantly available for use. Automatically you have a temporary storage facility that can be moved easily from job to job.

SUREWELD 6014 ELECTRODE:

An all position electrode for mild steel, it operates equally well on AC or DC. Approximately one-sixth of the deposited metal comes from the coating of this electrode, a thick coating with a substantial percentage of iron powder. The balance of the metal deposited comes from the core wire. In addition, the heavier coating has substantial heat capacity which permits higher current rates without damage to the coating. The result is an increase of 20% to 40% in deposition rate.

The "drag technique" may be used with Sureweld 6014 electrodes, with the tip held in contact with the plate, or with a free arc. These electrodes have found wide use for welding construction equipment, sheet metal, farm implements, foundry equipment, pressure vessels, pipe and fittings, etc.

This is only some of the information contained on the Sureweld 6014 Electrode Data Sheet . . . get this and others by writing or calling your nearby NCG office today.

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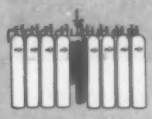
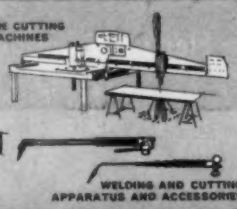

INDUSTRIAL GASES



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- A bold new concept in electrical design and circuitry is introduced in the all-new Miller BWC-300MAP. One of several notable results is complete and automatic elimination of the d-c component at all welding currents . . . an essential in certain critical welding applications.
- Due to the specially designed transformer, high arc initiation voltage and unique circuit, arc-outages cannot occur.
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- Optional equipment includes: Remote hand and/or foot controls; 10 or 40 gallon water coolant systems; running gear which carries welder with coolant system and gas cylinders.

EXCLUSIVES! — found only in new Miller BWC-300MAP:

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The outstanding versatility of this welder, and the specifics on its various features, are detailed fully on our form #BW-3 — a copy of which will be sent to you promptly upon request.

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BETWEEN PASSES

safety award

WELDING ENGINEER has again earned the National Safety Council's Public Interest Award. The non-competitive award annually honors exceptional service to safety by organizations in the mass communications field. A 1959 star has been added to the original plaque earned by *WE* several years ago.

Our sister publication, *The Welding Distributor*, was similarly honored for its espousal of safety during 1959.

electronic goggles

A recent Air Force report describes electromechanical goggles with eye-protecting light shutters that can close 20 times faster than the eye can blink. Developed to protect the wearer's eyes from burns or flash-blindness from high-intensity flashes, the goggles are equipped with alternate opaque vertical bars and transparent strips over each eye piece.

These high-speed light shutters are operated by an electronic device activated by a light-sensitive photo-detector. During normal use, the plates are positioned so that the bars of each plate are superimposed on those of the other plate. The wearer sees through the transparent slots. When a high-intensity flash is detected by the photo-detector, the amplified signal triggers a device that moves each pair of plates over the slots in the other pair, shutting out light.

The tiny closing mechanism can flick the shutters into position in less than 500 microseconds. Light transmission through the closed shutters is less than 0.01%.

miss weldor, 1960

THIS year's Miss Weldor, TV and motion picture actress Juli Reding, watches a welding demonstration by C. S. Tallman, technical consultant for Eutectic Welding Alloys Corp. Miss Reding was crowned at this year's Los Angeles Welding Conference at Huntington Park High School, sponsored by Eutectic. Such notables as Sophia Loren, Jayne Mansfield and Dorothy Malone have previously carried the title of Miss Weldor.

ideas for sale

Ideas, inventions and new products destined to increase our gross national product go on the auction block this month in Cleveland. The activity is the National Invention's Exhibition and Creativity Conference, sponsored by the Cleveland Engineering Society. It will be held June 20-24 at the Engineering and Scientific Center, and will include models of inventions by more than 150 inventors. All will be patented or patentable, and most of them will be for sale, lease or available for development.

The conference aspect of the affair will consist of five days of discussions and talks.

scholarships

The Chicago section of the American Welding Society has awarded $500 scholarships to two youths who exhibited at the annual high school Science Fair, held recently in Chicago's Museum of Science and Industry. The winners are Paul Leif and Thomas Keys.

Purpose of the awards is to emphasize the importance of welding in modern technology and to promote the study of welding engineering. The boys will receive the awards upon their enrollment in college.

Incidentally, *WE* will devote part of our August issue to welding education.

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in ✓ **plastics**
in ✓ **ceramics**
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USE **PIXchek** penetrant dye system for inspection after any metal-working process—casting, forging, welding, grinding, extruding, drawing, shearing—the gamut of operations. PIXchek is equally adaptable to single part or quantity-run inspection.

Everything you need is in this handy flaw-hunting kit

Sturdy steel hinged case with aerosol spray cans of PIXchek Dye, Cleaner, and Developer, plus extra cans of Dye and Cleaner for brush and wipe-on applications. The coupon below can start you flaw hunting right away.

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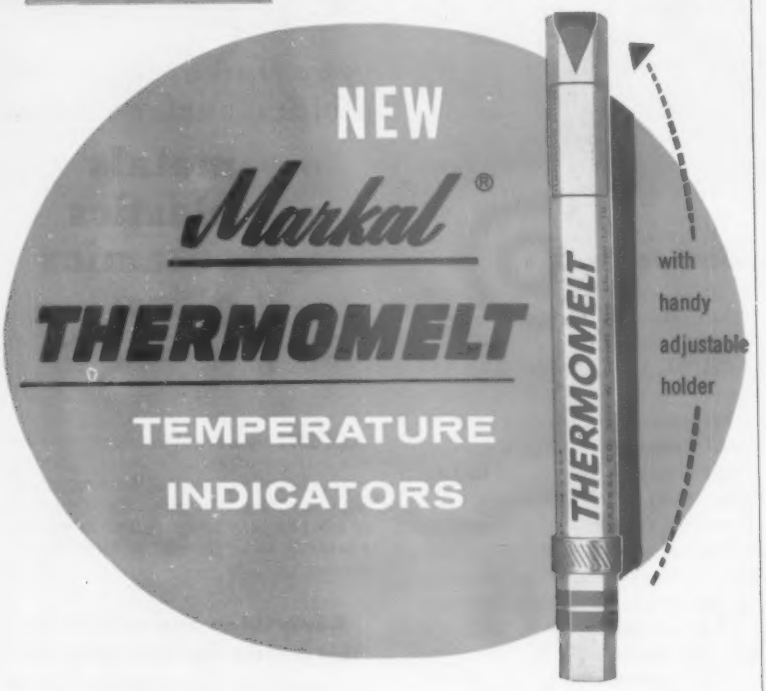
you know the *temperature!*



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A STIK FOR EVERY TEMPERATURE from 113°F. to 2000°F.

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30 YEARS AGO

(Taken from **Welding Engineer** of June, 1930)

C. E. Phillips & Co., Detroit, has opened an office in Grand Rapids, Mich., for handling Stoody Co. welding alloys, Tube Turns fittings and flanges and other welding products. J. C. Menzies is in charge.

—30 Years Ago—

The Vernon Welding & Machine Shop, Los Angeles, recently added a new 500-amp electric generator to its shop at 2227 E. 38th St. The shop is owned and operated by F. P. Nobbe and E. P. Frock.

—30 Years Ago—

In this issue, C. J. Holslag, chief engineer of Electric Arc Cutting and Welding Co., Newark, N. J., tells how flux coatings are aiding the progress of arc welding.

—30 Years Ago—

"Welding machinery and steel structures" is the title of an article in this issue written by A. M. Candy, welding engineer with Westinghouse Electric & Mfg. Co.

—30 Years Ago—

M. E. White, district manager of Burdett Oxygen Co. of Chattanooga, Tenn., recently conducted a very successful night training program for weldors and welding supervisors in the Knoxville territory. The course ran for two weeks.

—30 Years Ago—

The Lincoln Electric Co. has moved its Baltimore, Md., distributor's office. T. A. Canty is in charge of distribution for this territory. He recently appointed R. Rude as office manager and C. N. Hilbinger as sales engineer and service manager.

—30 Years Ago—

Among those presenting papers of interest to the welding industry at the meeting of the American Society for Testing Materials were C. H. Jennings and R. E. Peterson (on fatigue tests of fillet welds); D. L. Colwell (on silver solders); T. W. Downes (on joining processes used in the aircraft industry); H. L. Whittemore (on procedure control in aircraft welding); and Ancel St. John (on X-ray inspection of aircraft materials).

Photo courtesy Caterpillar Tractor Co.

For Speed and Economy in Flame Cutting Using Natural Gas

The use of Harris cutting torches accomplished the most economical balance between cutting speeds and oxygen consumption. Harris torches were selected over competing brands.

This installation permitted performance not otherwise possible and the gas savings are substantial.

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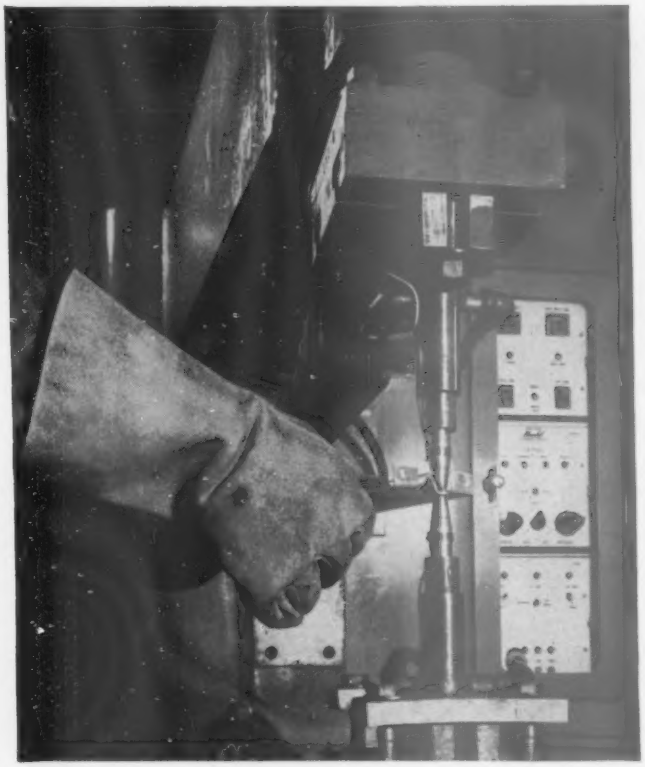
NEW FEEDBACK CONTROL
makes every weld count

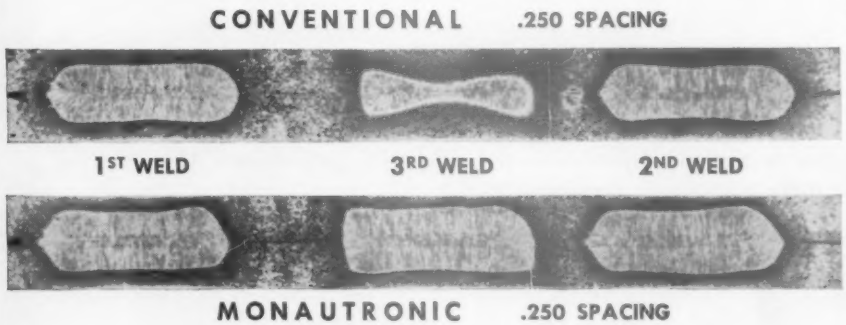


Information from electrodes is fed back to **Monautronic V-2** in background. Control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

Now, with the new **Monautronic V-2** welding control, you can make consistently top-quality welds over long stretches of time, without stopping to test and inspect sample welds. The control senses variations in line voltage, electrode shape and tip force, material thickness and surface finish . . . and compensates for them immediately.

The **Monautronic V-2** automatically compares actual voltage across the weld with command voltage, and adjusts current accordingly to maintain voltage—and weld quality—at a constant level. If weld resistance is too high or too low to produce a good weld, the control locks out until the condition is corrected.

Although the **Monautronic V-2** embodies the latest advances in computer-type circuitry, it is quite simple to operate, and easier to maintain than most conventional controls. For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.



The **Monautronic V-2** overcomes shunting effects by maintaining constant voltage across each weld, regardless of how closely spaced the welds may be. Photomacrographs compare closely spaced welds made with conventional control with those made with **Monautronic V-2**. Notice how shunting of voltage has weakened the center weld made with conventional control, while **Monautronic V-2** has kept all welds uniform.

ELECTRONIC Budd CONTROLS

2450 Hunting Park Ave. Philadelphia 32, Pa.
12141 Charlevoix Ave. Detroit 14, Mich.
3050 East 11th St. Los Angeles 23, Cal.

JUNE, 1960

Welding Engineer

ESTABLISHED 1916

To be or not to be?

"How can we get our weldors certified?" This is a question asked of Welding Engineer many times in the course of a year.

And since many specifications demand that work be done "by a weldor certified under AWS rules," the question has considerable merit.

Except for the fact that in all God's creation there is no such person as an AWS certified weldor — and few of any other kind!

Weldors *qualify* for a particular job by demonstrating their ability to weld according to the *qualified procedures* set up by the manufacturer for the particular job.

The *employer* must then *certify* that the weldor is able to do the specific job according to these stipulated procedures.

Is such certification necessary? Any fabricating plant planning to stay in business surely must have weldors capable of producing welds which will withstand the punishment of daily usage.

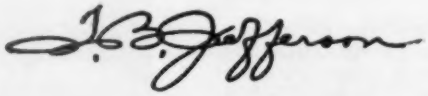
In addition, these shops generally re-test the weldors at periodic intervals after the initial tests given when they are hired.

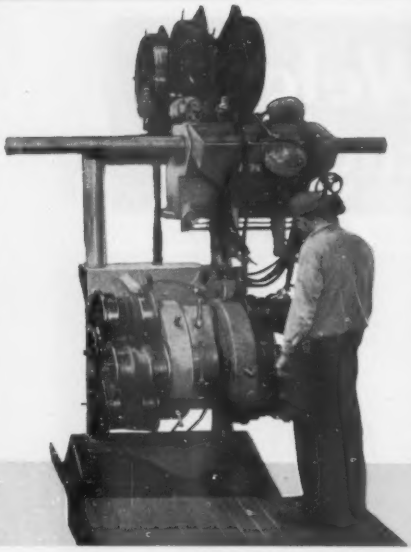
Thus, in essence, all weldors receive shop certification — and this would seem to be enough.

If it is not, then a universal certification plan should be established immediately — or else eliminate these requests for "certified weldors" from specifications.

Welding is too important a fabrication process to have its potential users milling around like sheep because they don't know where to go or what to do.

To be or not to be certified according to specifications calls for a clear cut answer. Let's have it and stop this foolishness.





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VICTOR MODEL "DEMS"

A big money-maker for anyone rebuilding tractor rollers and idlers on a production basis. Double-ended, multiple spindle mounts 8 track rollers, or 2 idlers, at a single loading. 360° rotation permits rebuilding all faces and flanges without additional handling. Automatic move-over assures uniform build-up. Dual wire feed cuts rebuilding time in half. Comes complete with power-saving power unit, specially engineered for automatic welding.

ROLLER FLANGE
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prevents flange wear and roll over (cause of many premature failures) by flame hardening renewed area to approximately 50 Rockwell C. Dual torches flame harden both inside and outside of flanges simultaneously.

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Save yourself a barrel of MONEY with these VICTOR Rebuilding Machines

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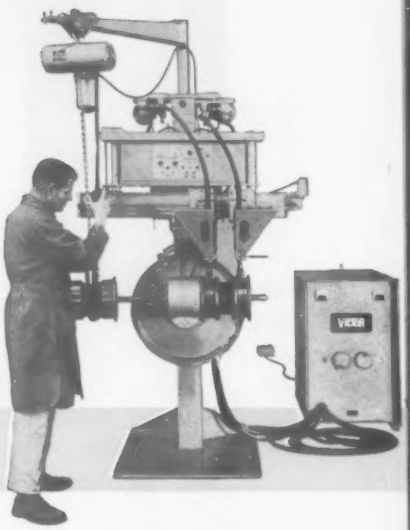

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Ideal for contractors and small repair shops. Produces same high quality work as larger Model DEMS, but mounts only two rollers or idlers at a loading. Has same type double wire feed, automatic move-over, and motorized positioning of work. Built-in jib crane (rated ¼-ton capacity) enables operator to handle rollers and large idlers with ease. Price includes power supply.

VICTOR FLUX GRINDER

processes 1500 pounds or more of fused flux per hour with very low flux loss. Sizes flux to factory specifications. Savings made by reclaiming only 12,000 pounds of flux returns low initial cost of grinder.

Mfrs. of high pressure and large volume gas regulators; welding & cutting equipment; hardfacing rods; blasting nozzles; cobalt & tungsten castings; straight-line and shape cutting machines; roller and idler rebuilding machines.

207

destructive testing

Quality control begins at the designer's drawing table and ends only when the shipping tag is placed on the finished product.

To insure that product's quality between designing and shipping, there are numerous controls and inspections — one of the most important of which is non-destructive testing.

Non-destructive testing— an important factor in quality control

NON-DESTRUCTIVE TESTING methods can easily be traced to the dawn of pre-recorded history when man first began using his intellect to fabricate his tools, housing and transportation.

Of course, his visual inspection methods cannot be compared to today's fast, efficient ultrasonic, radiographic, magnetic particle and liquid penetrant methods.

And since these modern means of inspection each render a particular service and can be used jointly in a specific situation, they're not competitive, but complementary.

However, before any inspection method can be used, it must be understood; and after it is understood, the results must be interpreted. Only then will these methods be of any use to industry.

Non-destructive testing begins with the materials to be used, continues during fabrication, and then ends with the final inspection of the finished product.

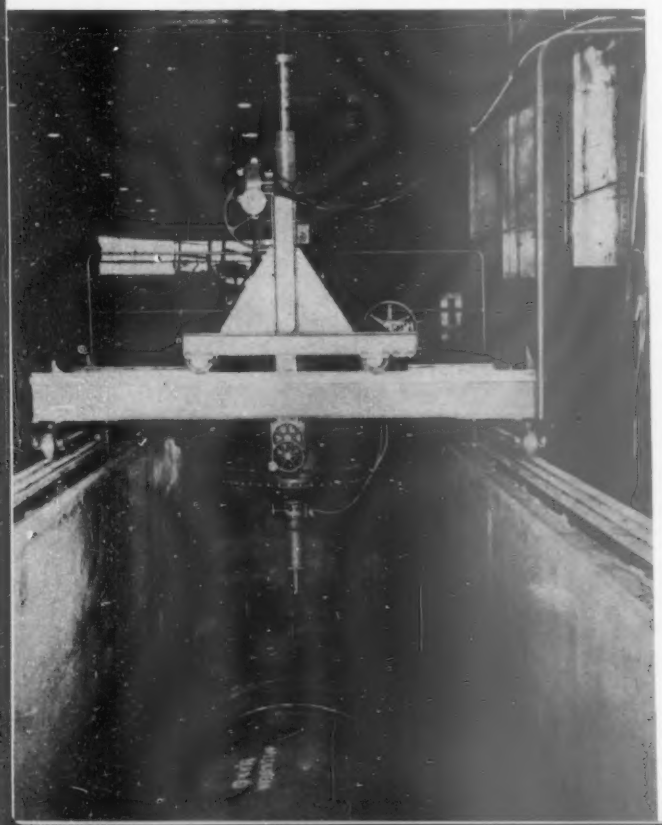
Since each testing method provides a specific result, use of the various methods is left to the fabricator's decision. On the following pages WELDING ENGINEER has detailed the more widely used of these; one or more is sure to fit into your quality control set-up.

Newest entry in the non-destructive testing field is ultrasonics. High frequency sound first saw extensive use during World War II with the development of sonar for detection of submarines and mines.

Still working on this principle of reflected sound, today's ultrasonic testing has carved a place for itself in the testing field.

High frequency sound does not travel very well through air, so a thin film of oil or water is used as a couplant. The sound waves then travel through the object — until they strike a flaw and are reflected.

This reflected sound is then translated into electrical impulses which can be seen, interpreted and evaluated on a reflectoscope screen.



MILLION-volt X-ray unit at Babcock and Wilcox Co., New York City, is ready to inspect pressure vessel in concrete pit.

Ultrasonic sound is also being used to analyze structural and machine part stresses. Called acoustoelastic and developed by researchers at Armour Research Institute, the method makes use of sound in the same way that photoelastic methods use polarized light.

This method has three advantages: actual structural materials can be studied directly instead of using a transparent optical model; residual stresses can be measured absolutely since sound wave lengths can be varied over a considerable range; and it is non-destructive.

The basic principle hinges on the existence of a stress-acoustic effect similar to the stress-optical effect. In the latter, light velocity is changed as a result of stress-caused refraction change.

Thus, just as polarized light beams indicate the stress distributions in an optically transparent object, the acoustoelastic method uses polarized ultrasonic waves. Progress is being made to convert the acoustical signals to optical energy.

Similar techniques are now being developed which allow for the determination of surface stresses predominantly caused by machining and finishing operations.

Here measurement is made by use of ultrasonic surface waves which penetrate the object's surface to a depth of a few thousandths of an inch. The wave will travel around curved surfaces as well as flat surfaces so that common shapes can be analyzed.

As can be seen, ultrasonics is a fast, economical inspection method. And even now refinements are being developed so that permanent records can be obtained — which is one of the advantages of radiographic testing.

Among non-destructive testing methods, radiography is definitely the most popular. In 1895, Wilhelm Konrad Roentgen discovered "some kind of invisible light" when a piece of barium platinocyanide paper began glowing. The only possible light source was a cathode-ray tube, *which was completely shielded.*

Word of this new or X-ray spread and the repercussions were felt everywhere. A congressman in-

PERMANENT magnet leech permits one man to operate powder blower and prod during magnetic particle inspection of this structure.

troduced a bill to prohibit use of X-rays in opera glasses. A London firm "made prey of the ignorant women by advertising X-ray-proof clothing."

New York newspapers suggested the X-ray was the answer to spiritualism, soul photography and possibly even transmission of knowledge into the brain.

Roentgen invited the world to help develop this X-ray whose penetration increased with increased voltage and could produce a shadow image on photographic plates.

Only 18 years after Roentgen's discovery a significant contribution was made by William D. Coolidge, later vice-president and research director for General Electric Co.

Dr. Coolidge developed better, high-powered X-ray tubes through his use of tungsten filaments, by vacuum-casting copper around tungsten targets and achieving near-perfect vacuums. Because of these contributions, million-volt X-ray units are common sights.

An X-ray or radiograph is similar to a photograph except that it is fundamentally a shadowgraph, *i.e.*, showing light and dark areas depending on the density of the material receiving radiation.

If this shadowgraph is projected on X-ray film for permanent record, the process is known as radiography; if projected on a fluorescent screen, it is called fluoroscopy.

A more recent refinement of fluoroscopy is a rapid (up to 10 ft per minute) production line system where X-rays are projected on a television rather than a fluorescent screen.

Called TVX and developed by General Electric (see *WE, Oct.* 1958, *p* 80.) the television screen produces an image 10,000 times brighter than conventional fluoroscopy — bright enough for easy viewing in normal light.

Image size can also be electronically varied from one-half to three times the original object's size. Although not a substitute for film radiography, it is a tool for expanding fields where 100% radiography is used in applications where film is now used unnecessarily.

Production of radiation, however, is not confined to a cathode-ray tube. Pierre and Marie Curie in their successful attempt to isolate radium gave rise to gamma-ray inspection about the same time that Roentgen made his discovery.

Working on the same principle of light and dark areas as in the X-radiation method, radium was used until 1934 when scientists learned that the newly invented atom-smashers (cyclotrons) could induce radio-activity in normally stable chemical elements.

Although radium's half-life (the time it takes to lose half its strength) is 1,620 years, supplies were limited. So with the achievement of nuclear fission in 1942, the door opened to a fuller realization of the uses of radioisotopes.

Since the first man-made isotope, carbon 14, many others have been developed: cobalt 60, iridium 192, cessium 137, thulium 170 and samarium 153. And all are used in non-destructive testing.

For example, cobalt 60 has a half-life of 5.3 years and an equivalent X-ray energy of 2,000 kv. Thus, in 5.3 years it would take twice as long to make a film exposure — but the quality of the radiation is constant, making radiograph quality constant also.

The oldest and cheapest of all inspection methods, of course, is visual inspection. However, two other non-destructive test methods take over where the eye must leave off: magnetic particle and dye or fluorescent penetrant.

A "magnetic dust" test method was successfully applied to oil well drill pipe in 1929. This forerunner of today's magnetic particle inspection was developed and perfected by A. V. de Forest.

The method utilizes magnetized particles which are applied in a dry or wet-suspension state to a workpiece in which an intense magnetic field has been formed.

Cracks or other discontinuities interrupt the magnetic field and align the flux along their edges, thus acting as local magnets.

Indicating surface imperfections in another way are the dye and fluorescent penetrant methods. Applied to a clean surface by brush, spray or immersion, the penetrant finds its way by capillary action into the finest cracks.

Excess is then wiped off and a developing fluid spread on the surface. This draws the penetrant up to the surface and spreads it on either side of the crack. If the penetrant is a dye, it can be seen under normal white light; if a fluorescent, a black light is used.

There are other non-destructive testing methods, as well as many refinements of the methods mentioned. (See p. 44 for details on these and other methods.)

And for as long as industry continues to require dollar and time savings — and basic quality control — new and modified non-destructive testing methods will be developed and perfected.

QUICK leak test on open welded tank shows how dye penetrant is sprayed on inside of weld seam.

Isotopes vs X-ray

Circumstances and job requirements govern selection of radiation source in inspection

by **John A. Reynolds**
Picker X-ray Corp.
White Plains, N. Y.

THE NEED FOR PERFECTION in components for nuclear reactors, missiles and space vehicles has done much to stimulate use of radiography.

Being able to inspect the internal state of almost any material non-destructively permits testing of industrial products in almost every phase of fabrication, as well as in its finished form.

And with radiographed objects ranging from golf balls to foot-thick steel, a wide range of X-ray units and isotopes are needed. However, no single unit or isotope is suitable for all jobs.

Selection of either gamma or X-radiation for a particular inspection must be based on circumstances and job requirements. Affecting this selection of proper radiographic equipment and technique are the following factors:

(1) Material density, which may range from aluminum to uranium.

(2) Thickness of the material, which can range from airplane skin to 12-in.-thick steel.

(3) Time available to do the job. Must the job be done on the production line or could an overnight exposure be made?

(4) Accessibility. Can the object to be inspected be brought to the machine or must the machine go to the object?

(5) Conformation. A flat plate is easier to examine than a complex casting.

The prospective user of radiography should seek objective and skilled advice, tailored to his particular requirements, before deciding between radioisotopes and X-ray.

Whether gamma radiation or X-radiation is better cannot be determined unless the requirements of a given case are first studied. Although isotopes are performing jobs never possible with X-ray, there are still many jobs that can be done better with X-ray.

There are several generic differences between the two radiation sources, and whether a particular quality is an advantage or disadvantage depends on circumstances.

However, these differences can be used as a guide to selection of the radiation source best suited for a particular application.

The kilovoltage and, therefore, the radiation energy of an X-ray machine can be adjusted over a wide range, making it suitable for a variety of materials and objects and permitting the user selection of an optimum value for each job.

On the other hand, each isotope gives off its own characteristic quality of radiation at all times and there is no change in its penetrating power.

An X-ray machine can be turned on and off at will; it does not give off its rays day and night as does the isotope source.

Obviously, caution must be used in handling isotopes, but this is hardly an objection to its use. Atomic Energy Commission surveillance of equipment design and construction, plus extensive training, has reduced hazards to incon-

X-ray energies for typical materials

Kilovolts	Aluminum	Steel	Bronze
50	½ to 1 in.	—	—
140	1 to 3 in.	¾ to 2 in.	½ to 1 in.
200	3 to 5 in.	1 to 3 in.	¾ to 1¼ in.
260	—	2 to 3½ in.	1 to 2 in.
300	—	2 to 5 in.	2 to 4 in.
1000	—	3 to 6 in.	3 to 5 in.
2000	—	4 to 8 in.	—
24000	—	6 to 20 in.	—

TABLE 1 — X-ray units are adjustable as to energy of their penetrating rays which can be regulated to suit material thickness.

sequential proportions.

When radiographing with isotopes, there is no need for electrical power; work can be done in the field, on a high scaffold, or anywhere with no need for a power supply line.

On the other side of the picture, however, obtaining proper power is usually a nuisance, sometimes a hazard and occasionally completely rules out the use of X-ray machines.

X-ray machines often can be made to produce more intense radiation, permitting shorter exposure times than are practical with isotopes. Improved availablity of high specific-activity isotopes has minimized this difference, but there are still many applications where an X-ray machine is the only way to get the job done fast enough.

However, the fact that an isotope source emits radiation in all directions may outweigh this X-ray advantage because more than one exposure can be made simultaneously, *e.g.*, circumferential welds.

It is easier to control exposure with an isotope unit than with an X-ray machine, since there is only one exposure factor—time—that must be set on the control.

With an X-ray machine, however, it is necessary to set up the kilovoltage, milliamperage and time, as well as line voltage compensation in many cases.

Reduction in the amount of incorrectly exposed radiographs is another result of the isotope's easy operation and freedom from power supply fluctuation problems.

As can be seen, maintenance of isotope units is simple and breakdowns infrequent. Although industrial X-ray units are rugged, the chance of down-time because of electrical failures (either in the machine or in the power supply line) is much greater.

Another major factor in the increasing use of isotopes for industrial radiography is their low cost. For example, an iridium 192 unit with a capacity of 50 curies costs $1,950 and, on the average, will radiograph 1-in.-thick steel with a 2 1/2 minute exposure at a 30-in. focal distance.

On the other hand, an X-ray machine to do a similar job must be in the 200 to 260 kv range and costs between $6,000 and $8,000.

Of course, the expense of buying 50-curie iridium 192 sources and replacing them often enough to keep exposure times within reasonable limits will range between $1,000 and $1,800 a year.

When materials equivalent to 1 to 2-in.-thick steel are to be inspected, a cobalt 60 unit costing $2,500 (plus an average $80 per year for the isotope) does the job that would require a 260 to 300 kv X-ray machine costing between $7,000 and $12,000.

At the high side of the scale, a 1,000 curie isotope unit represents an investment of about $25,000 to $30,000, including the isotope source. But it does the job of a super-voltage X-ray machine costing from $50,000 to more than $100,000.

On the plus side of the X-ray machine ledger, there is no high operating costs. However, tube breakage must be considered, especially in portable units where repair and maintenance costs may well exceed $500 a year for field work.

More important is the down-time involved in returning an X-ray machine to a repair depot or waiting for a service man. But it takes only five minutes to change the source in an isotope unit. Some designs do require that the isotope units be returned to the factory for source replacement, but this involves only a little more than shipping time.

Isotopes have made many types of radiographic inspection possible that could never be done with X-rays. They have made many jobs easier and brought improved results to many other jobs.

However, it is not true that radioisotopes are displacing X-ray machines. In many situations a specific requirement involving the shape and accessibility of the object to be inspected, or the time and production rates involved, will completely rule against one and for the other.

A decision on the proper unit for a specific job should be made only after the particular requirements of each case are studied, and then seeking objective and unbiased advice.

Isotopes compared to X-ray energies

Isotope	Half-life	Equivalent energy
Cobalt 60	5.3 years	2000 kv
Iridium 192	75 days	400 kv
Cesium 137	30 years	600 kv
Thulium 170	27 days	100 kv
Samarium 153	47 hours	75 kv

TABLE 2 — Gamma rays are physically and radiographically equivalent to X-rays, so various isotopes can be compared to X-ray energies.

by Robert Chuse

In non-destructive testing, the test is only as good as the explanation of the results, so it is important to know . . . .

How to interpret RADIOGRAPHS

LESS WELD METAL, reduced welding time and, consequently, dollar savings if radiography is used when fabricating pressure vessels.

Since the ASME Unfired Pressure Vessel code allows higher welded joint efficiencies in a vessel that is radiographed and/or spot radiographed, these results are definitely possible.

Complying with the code, any vessel, if radiographed, can be built for the same pressure and diameter using thinner shells and heads.

However, a radiograph is only as good as the interpretation given it—and this is the most important factor in any phase of non-destructive testing.

Gamma and X-rays are short, electromagnetic waves which, because of their shortness, can penetrate metals impervious to ordinary light. When these waves penetrate metals, some radiation is absorbed, the amount depending on wave length and material thickness and density.

If a defect, such as a crack, slag inclusion or porosity, exists in a material of uniform thickness, the section containing the defect is less thick, thus allowing radiation to pass through it.

The increased radiation passing through the defect's lesser density blackens the film which shows an X-ray shadow of the defect in the weld or plate material.

X-ray radiographs show defects more sharply than gamma ray, and this must be taken into account when interpreting a radiograph. This difference in contrast may cause over- or under-estimating by persons familiar with only one.

The ASME code states: "The weld shall be radiographed with a technique which will indicate the size of defects having a thickness equal to, or greater than, 2% of the thickness of the base metal."

As a check on radiographic technique, penetrameters or thickness gages are used. Penetrameter thickness must not exceed 2% of the plate thickness, but need not be less than 0.005 in. when radiographing thin plates. It should be of the same metal as the plate or vessel being examined.

Sensitivity, as measured by the penetrameter, is understood to be the smallest fractional thickness difference in the material being radiographed which can be detected visually on a radiograph.

Often radiographs of welded seams have had to be retaken due to improper technique in taking the film or difference of opinion in film interpretation. The retake proved one or the other wrong.

Basically, the important questions to be considered in radiographic inspection of welds are:

(1) Has the radiograph of the weld been properly taken?

(2) Has complete penetration of the weld been obtained?

(3) Are visible defects acceptable, or should they be repaired?

Proper radiography will show any change in metal thickness above the 2% contrast sensitivity required by the ASME code. Any defect larger than the minimum size (slag entrapment, porosity, lack of penetration, undercutting,

cracks) will show on the radiograph.

Defects will be recorded as dark areas when compared with normal density of sound metal areas. Weld reinforcements, backing strips, splatter and icicles will show as light areas since they are thicker than the average plate thickness.

In burn-through areas, the burn-through itself is a darker irregular image, but the drip-through surrounding the blow-through will be lighter. In high absorbtion material, burn-off shows as light density areas, usually spherical.

Not every discontinuity in film density is objectionable. If the vessel is to be radiographed entirely, the code permits certain slag inclusions according to plate thickness: 1/4 in. for plate thickness up to 3/4 in.; 1/3 of the plate thickness for thicknesses from 3/4 to 2 1/4 in.; and 3/4 in. for plate thicknesses over 2 1/ 4in.

Not acceptable is any group of slag inclusions (in a line having a total length greater than the plate thickness) in a length of 12 times the plate thickness. The exception is when the distance between the successive imperfections exceeds six times the length of the largest imperfection.

However, any crack or lack of penetration is not acceptable and must be repaired, while porosity is judged by comparison with the standards in the code.

But when only spot radiography is required, the standards are less demanding since film length need only be 6 in. (but not less) and porosity is not a factor in acceptability of the welds.

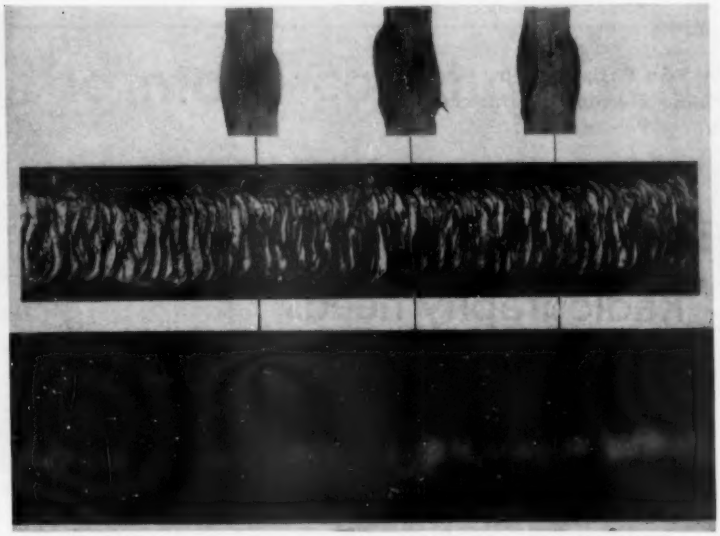
Note the differences in other allowable defects:

Any weld showing cavities or elongated slag inclusions shall be unacceptable if the defect is longer than 2/3 thickness, where thickness is that of the welded joint's thinner plate.

Any group of imperfections in a line (and which have a total length greater than the plate thickness) within a line 6 times the plate thickness, is not acceptable. The longest defect must be separated by acceptable weld metal equal to three times its length.

(Since the minimum length required for spot radiograph is 6 in., this length shall be proportional for radiographs shorter than six times the thickness.)

Any defect shorter than 1/4 in. is acceptable, but any defect longer than 3/4 in. is not. And any welds showing any type of crack or lack of penetration are not acceptable and must be repaired.



COMPARISON of typical weld cross sections and radiograph shows location of porosity (which appears as dark spots).

When a spot radiograph shows welding which does not meet code requirements, two additional spots must be taken in the same seam at locations chosen by the inspector and away from the original, preferably one on each side of the defect.

If these additional spots do not meet code standards, the joint must be rewelded, or at the fabricator's option, the entire unit may be radiographed and only the defective welding repaired. The rewelded areas, of course, must be spot radiographed and meet code requirements.

Film handling and processing can cause marks which simulate weld defects. A fine scratch on the film surface may look like a crack; water marks, stains and streaks may also look like defects. However, when viewed in reflected light, these can readily be determined.

Here are a few tips on defect identification and location:

A crack running perpendicular to the plate surface can easily be seen, but cracks along the fusion line often are on an angle and the defect image may not be sharp. Parallel defects may not show up.

Cracks appear mainly longitudinally to the weld, in the weld, in the fusion line, at craters and, occasionally, in the plate adjacent to the weld. Transverse welds are not seen too often, but do appear in the weld and plate edges.

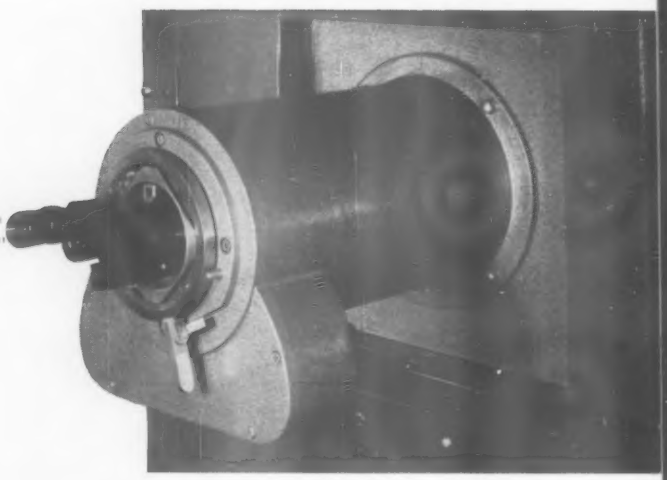
Slag inclusions in a weld are usually sharp and irregularly shaped. As stated above, certain small size inclusions are acceptable according to the code, but elongated slag or many slag inclusions in a line are not desirable.

Incomplete penetration usually appears in a sharp delineation and also is not acceptable. Undercuts are usually seen at the weld edge while porosity shows up as dark spots. These spots, defined as fine or course, are measured by code standards when complete radiography is required.

An important factor when viewing radiographs is to assure proper placement of the penetrameters and to have the penetrameter holes showing. If the radiographic technique is correct, the obvious defects will be seen, so the not-so-obvious defects should be the center of attention.

by **John P. Battema, Jr.**
Philips Electronic Instruments
Mount Vernon, N. Y.

Radiography needs anticipated, met by manufacturers



SPACE AGE REQUIREMENTS, from missile fuel tanks to the new, exotic metals used in nuclear applications, have given non-destructive testing an increasingly important role.

The techniques and quality standards required by these new industries for their welded components necessitated new concepts in radiographic inspection.

In the past, large focal spots and coarse grain film might have been adequate for detecting larger discontinuities. But now smaller indications, previously undetected and considered acceptable, are cause enough for rejection.

To be able to discover these defects, radiographic equipment manufacturers and film producers had to develop fine focus X-ray tubes, more efficient X-ray generators and fine grain, higher contrast film.

One such product is a 0.4 mm fractional focus tube, developed by Philips, which operates in a 50 to 150 kv range. It is capable of radiographing sections in thickness and density ranging from ⅛-in. aluminum or magnesium to 1½-in. steel.

Considerably heavier steel sections can be X-rayed if calcium tungstate screens are used.

The fractional focal spot virtually eliminates the penumbral shadow effect associated with larger diameter focal spots. This shadow effect is like a fuzzy negative produced by a low-grade or improperly focused camera lens.

On the other hand, when radiographing critical weldments, clarity and detail produced by fine focus X-ray tubes can be compared to a negative made by a high quality, properly focused lens, detecting the very small, but important, discontinuities.

A recent refinement is a 0.7 mm fractional focus tube with a beryllium window. The tube operates in the 25 to 150 kv range; produces a high roentgen output of long-wave radiation in the lower kv ranges.

The fractional focal spot plus the window results in extremely high definition and contrast when radiographing very thin sections of light alloys.

Another development for the welding industry is a 360-deg, rod anode tube with a hollow rod approximately 2 in. in diameter and 18 or 25 in. long.

The electron stream is electrostatically focused through this rod to the anode or target located near the rod end, producing radiation in a circle.

Thus, it is possible to place 70 mm film over the entire circumferential weld and radiograph it in one exposure. With conventional X-ray tubes many exposures would be required.

This tube, as well as conventional X-ray tubes, can also be used for in-motion radiography of longitudinal welds. Here the X-ray window is fitted with a slit diaphragm which reduces the beam to a narrow angle. Film is placed on the weld and the weld is then moved over the X-ray tube at a predetermined speed.

The film is progressively exposed, resulting in a single radiograph of the entire weld.

For inspection of somewhat less critical weldments, electron fluoroscopy is being used. In this application an image intensifier is coupled with the X-ray unit.

The rays penetrate the welded section and the image is produced on a fluorescent screen inside the tube. By means of a photocathode, this image is converted to electrons which are then accelerated and focused on a small diameter phosphor.

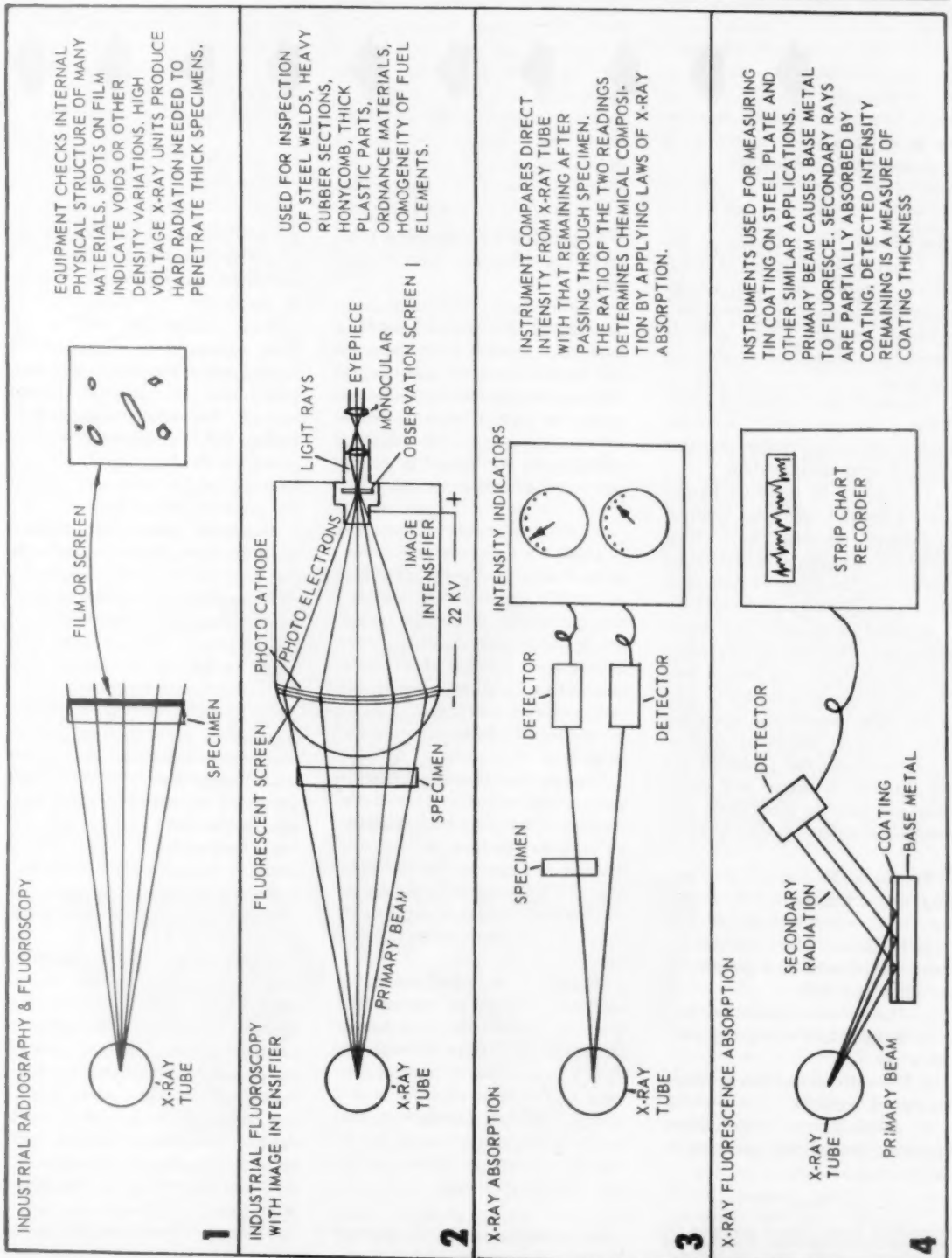
Image brightness is increased more than 1,000 times and is viewed through a magnifying binocular or closed circuit television system.

Although definition obtained is not as great as with fine grain film, it is adequate for many applications, and savings in both time and cost make it attractive for steel pipe inspection. (See p. 54.)

By using this image intensifier with a supervoltage X-ray unit, steel sections up to 12-in. thick have been successfully inspected.

Radiographic equipment manufacturers are keeping abreast of these increasingly more critical demands of the welding industry by developing new and more highly specialized equipment each year.

Four of the more common X-ray methods


INDUSTRIAL RADIOGRAPHY & FLUOROSCOPY
FILM OR SCREEN
SPECIMEN
X-RAY TUBE
EQUIPMENT CHECKS INTERNAL PHYSICAL STRUCTURE OF MANY MATERIALS. SPOTS ON FILM INDICATE VOIDS OR OTHER DENSITY VARIATIONS. HIGH VOLTAGE X-RAY UNITS PRODUCE HARD RADIATION NEEDED TO PENETRATE THICK SPECIMENS.
1
INDUSTRIAL FLUOROSCOPY WITH IMAGE INTENSIFIER
FLUORESCENT SCREEN
PHOTO CATHODE
PHOTO ELECTRONS
LIGHT RAYS
EYEPIECE
MONOCULAR
OBSERVATION SCREEN
IMAGE INTENSIFIER
22 KV
SPECIMEN
PRIMARY BEAM
X-RAY TUBE
USED FOR INSPECTION OF STEEL WELDS, HEAVY RUBBER SECTIONS, HONYCOMB, THICK PLASTIC PARTS, ORDNANCE MATERIALS, HOMOGENEITY OF FUEL ELEMENTS.
2
X-RAY ABSORPTION
INTENSITY INDICATORS
SPECIMEN
DETECTOR
DETECTOR
X-RAY TUBE
INSTRUMENT COMPARES DIRECT INTENSITY FROM X-RAY TUBE WITH THAT REMAINING AFTER PASSING THROUGH SPECIMEN. THE RATIO OF THE TWO READINGS DETERMINES CHEMICAL COMPOSITION BY APPLYING LAWS OF X-RAY ABSORPTION.
3
X-RAY FLUORESCENCE ABSORPTION
DETECTOR
STRIP CHART RECORDER
SECONDARY RADIATION
COATING
BASE METAL
X-RAY TUBE
PRIMARY BEAM
INSTRUMENTS USED FOR MEASURING TIN COATING ON STEEL PLATE AND OTHER SIMILAR APPLICATIONS. PRIMARY BEAM CAUSES BASE METAL TO FLUORESCE. SECONDARY RAYS ARE PARTIALLY ABSORBED BY COATING. DETECTED INTENSITY REMAINING IS A MEASURE OF COATING THICKNESS
4

Courtesy Philips Electronic Instruments, Mount Vernon, N. Y.

How to establish a program for

Radiation safety

by R. O. Gorson
*Jefferson Medical Center**

THE DEVELOPMENT of atomic energy, and increased in use of radioactive materials and high energy radiation sources have aroused considerable concern about possible genetic and individual effects from exposure.

Industry's growing use of radioactive isotopes and radiation sources, therefore, makes radiation safety a vital consideration.

Techniques of radiation hazard control depend upon the kinds of radioactive materials used, their radiation characteristics, operating procedures, the extent of operations and the number of people involved.

In some cases, as in the operation of a nuclear reactor, the problems are complex and hazard control constitutes an appreciable part of the total capital and operating costs. In most industrial applications, however, the problems are not difficult to define and safety programs can be established and maintained without undue expense.

Factors to be considered in setting up a successful safety plan may be grouped as follows:

1. Radiation safety criteria — standards of maximum permissible radiation exposure.
2. The potential radiation hazards associated with proposed radiation use.
3. Design, construction or reconversion of facilities.
4. Administrative organization, operating procedures, and personnel training.
5. Methods for continuous evaluation of adequacy of radiation safety.

In evaluating radiation hazards, one should differentiate between total and limited body exposure and between external and internal radiation sources. When X-ray machines or gamma emitting sealed sources are used, as in industrial radiography, the hazard is usually one of total body exposure.

Thickness gages and static eliminators are usually manufactured as sealed sources with windows thin enough to permit the escape of alpha or beta radiation. The hazard from external alpha radiation ordinarily is insignificant, but beta radiation can produce injury to superficial layers of exposed body area.

Perhaps the greatest danger in the use of sealed sources is the possibility that they may eventually leak to produce serious contamination hazards. For this reason, the periodic "leak testing" of most sealed sources is required by the AEC and by some state agencies.

Radioactive materials handled in loose form present an internal hazard from possible ingestion, inhalation or by absorption through the skin. This may be the primary concern in the fabrication of sealed sources, in the manufacture and use of radioactive luminous paints, and in research activities involving radioactive tracers.

In evaluating internal radiation hazards of a given material, important factors are half-life, energy and type of radiation emitted, and metabolic and turnover rate within the body.

Some radionuclids such as tritium, carbon-14 and chromium-51 are relatively harmless when compared with the internal disposition of other radioisotopes such as radium-226, polonium-210 and strontium-90. In general, isotopes emitting alpha radiation present the greatest internal hazard.

Maximum permissible internal radiation dose limits are basically the same as for external exposure. AEC regulations list tables of maximum permissible concentration of radionuclids in air and water that might be inhaled or ingested during occupational exposure.

To safeguard public health, the permissible concentrations in air and water released into uncontrolled areas are 1/10 the values permitted in controlled areas. Specific information on the internal hazards of radioactive materials is available from a number of sources, including National Bureau of Standards, handbooks 52 and 69.

A properly designed radiation installation or radioisotope laboratory can greatly facilitate the smooth operation of a radiation safety program. A high degree of safety can be built into "fixed installations" by appropriate shielding, safety interlocks and warning devices; in mobile operations, safety is largely dependent upon the skill and knowledge of the operator.

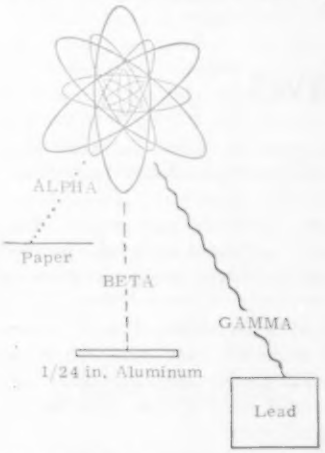
In areas where unsealed radioactive materials are to be handled,

*Condensed from a paper prepared for the Conference on Industrial Uses of Radioisotopes, at the Franklin Institute, Philadelphia.

the floors, walls, sinks, and laboratory furniture usually call for nonporous materials or coatings to facilitate good housekeeping and to simplify decontamination procedures in the event of spillage. Dry boxes may be used in some procedures where the spread of radioactive dust may present a problem.

Special radiochemical hoods may be required for the synthesis of radioactive materials or in situations where radioactive chemicals may volitalize and gases can escape.

Consideration must be given to the layout of the ventilation system to prevent possible leakage of contaminated air into uncontrolled areas. Storage and disposal of radioactive wastes may present



ALPHA, beta and gamma rays have varying penetration strengths, as shown by this diagram. Large, slow moving alpha particles are much more easily stopped than shorter-wave gamma rays.

problems that affect the laboratory or plant design, as well as the specifications for the sanitary sewer system and the design of plant incinerators. Strict regulations govern the disposal of radioactive matter.

Finally, one should consider personnel movement patterns and functional design in order to isolate the more hazardous areas and to limit the amount of space that must be considered restrictive.

Establishing a radiation safety organization is essential in any plant or laboratory handling radioactive materials and radiation sources.

In some industrial installations, it may be necessary to employ professional health physicists. In most cases, however, the plant safety engineer or other personnel with additional training can assume responsibility for supervising the control program, and for providing the necessary instruction and training to employees who will handle radioactive isotopes or operate radiation sources.

The lines of responsibility from management to the individual worker must be clearly spelled out — each person should understand clearly his responsibility and duties in the organizational chain. Written operating procedures should outline in detail the administrative control program, radiation safety procedures, and emergency steps to be taken in the event of an accident.

The individual with primary responsibility for the program must keep up to date with the regulations and requirements of the AEC and other federal and state agencies. He should see that careful records of the receipt, use, transfer and disposal of radioactive materials are kept as well as records of personnel monitoring and area radiation surveys.

A definite education and training program is an essential feature of any health and safety program. Rarely is it feasible to approach 100% safety by engineering and shielding alone. One must rely to some extent — and in some instances completely — on the actions of an individual to protect himself and his fellow workers.

Adequacy of the radiation safety program should be under continuous evaluation. Wearing film badges may be one means of accomplishing this, but these and other personnel dosimeters should not be relied upon exclusively. It should be remembered that film badge readings are an indication of exposure to the film. Depending upon circumstances, the reading may bear little relationship to an individual's exposure.

Even under optimal conditions, uncertainty in the film badge readings are likely to be no less than plus-minus 20%. Frequently, the error is much greater. For work involving radioisotopes that emit only alpha or soft beta radiation, the use of film badges and pocket dosineters are worse than useless since the low readings tend to promote a false sense of security.

Periodic blood counts should not be used as a means of monitoring exposure. Gross over-exposure, on the order of 25 roentgens or more, are required to produce a significant depression in the white blood count. On the other hand, blood counts are an important part of routine medical examinations to evaluate a worker's general state of health.

It is advisable to perform two monthly blood counts on workers before they are assigned to radiation duties in order to establish a baseline for later comparison in the event of an accident involving gross over-exposure. Persons with certain abnormal blood characteristics should not be allowed to work near radiation sources without first obtaining competent medical advice.

The best method for maintaining an adequate safety program is by periodic spot checks of operating procedures, by frequent area monitoring and contamination surveys, and by careful inventory of radioactive materials as they are received, used, and disposed.

It is necessary, of course, to provide suitable radiation survey instruments and to keep them in operating condition and properly calibrated. It is equally important that persons making radiation safety surveys have sufficient training and experience to do so with competence, and to be able to properly interpret the readings.

Thus, the importance of maintaining careful records should be emphasized.

Inventory records of the receipt, utilization, transfer and disposal of radioactive materials, personnel monitoring and exposure records, film badge reports, radiation survey reports, and records of actions taken by the radiation safety organization — all these should be kept.

Keeping detailed records is usually considered to be an administrative nuisance. In the long run, however, accurate records can save much unnecessary trouble.

ULTRASONIC TESTING

is a fast, economical means of discovering weldment flaws

ULTRA OR "SILENT" SOUND used to have only one practical application: calling the dog home without rousing the neighborhood.

During World War II, however, with its need for anti-submarine warfare devices, ultrasonics took its first giant step, thanks to the development of sonar.

Now, still using sonar's basic sounding principle, the silent servant has become one of industry's major non-destructive testing tools.

Basically, all ultrasonic testing is the same — sound transmission. They differ only in method, and can be divided into three groups: pulse-echo, through transmission, and resonance.

In the pulse-echo method, short ultrasonic pulses are transmitted from a transducer through a couplant (an oil film, since high-frequency sound has poor air-transmission) to the part to be inspected.

The echo is produced when a portion of the sound pulse is reflected back to the listening or receiving transducer by some surface. This echo is then translated into small electrical impulses which appear as "pips" on a reflectoscope screen.

The first pip, or initial pulse, is made by the part's top surface as sound waves enter. The remaining, non-reflected sound continues on to the next intersurface, usually the part's opposite or bottom surface. There it is reflected and appears as the last pip on the screen.

Since the speed of sound is constant, the time-lapse between the first and last pip can be translated into material thickness.

These points will have the same space relation regardless of the transducer's location — as long as the material's thickness and sonic qualities are not changed.

Should the sound pulse encounter a flaw, another pip will appear between the initial and final pips. Thus, the location of the flaws relative to thickness can be determined.

(One manufacturer, Branson Instruments, Inc., Stamford, Conn., has a calibrated weld ruler coupled to its ultrasonic tester to obtain precise locations of the defects.)

In order to obtain adequate results, of course, sound must enter the part uniformly. And since the transducer must make good contact with the part's surface, all loose scale and weld spatter must be removed from the contact area.

Measurement of the defect includes not only its size, but wherever possible, an evaluation of the defect type as well.

Height or size of the pip on the reflectoscope screen indicates the approximate reflecting area of the flaw. For example, a crack or void, however tight it may be, will have a larger reflecting area than a solid inclusion of the same area, which allows some sound to pass through.

A welded sample of the same type and size as that being tested, with similar flaws of the same type and size suspected, would be an ideal comparative. However, this is highly improbable.

So evaluation is conducted by means of test blocks containing artificial flaws of about the same general size and depth-in-material as the reflected flaws in the test part.

These man-made flaws (drilled holes in either the part to be inspected or a separate but similar part) have their ultrasonic signals compared with those of the natural flaws in the part.

Hole diameters vary from 3/64 to ¼ in. in increments of 1/65 in. The hole size commonly used is a

1/16-in. diameter by ¾-in. deep.

In the second ultrasonic testing method, through transmission, the sound system is the same with one difference: two transducers, one to send and the other to receive the sound at the opposite end. The sound transmission can be a pulse or constant.

Because of this method's one-way trip for sound transmission, it has the advantage of greater penetration, and is capable of working on materials too thin for the pulse-echo method.

(Minimum thickness limitations is one disadvantage of the pulse-echo system.)

However, through transmission does not give relative depth location of the flaw, only presence and magnitude, which may be all that is needed.

The third ultrasonic testing method, resonance, differs from the first two in that its sound tone is constantly varied, *e.g.* from two to four million cycles per second. And this change is repeated many times per second.

The basic principle in this method is that any piece of material has a natural frequency or resonance point to a sound wave beamed in its thickness direction.

This point is a function of the thickness and speed of sound in the material; sound speed being independent of frequency and almost constant for a given material.

The transducer sends the sound wave into the part, and at some given moment a frequency is transmitted whose wave length is an even multiple of the material's thickness.

The location of the pip or pips indicating flaws on the reflectoscope screen are then translated directly into thickness on a transparent chart superimposed on the screen face.

As mentioned above, high-frequency sound has poor air-transmission and, hence, a coupling medium must be used. The three ultrasonic testing methods described use contact-inspection with a couplant between the transducer and the part to be tested.

A second coupling system (which cannot be used with the resonance method) is immersion, in which the zone between the transducer face and the material being tested is submerged, usually in water.

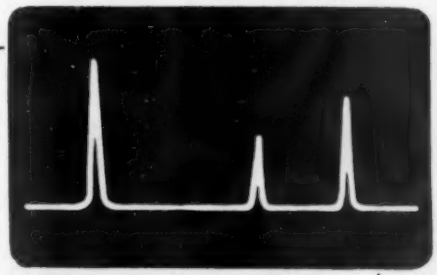
This system is ideal for testing small and medium sized parts and is widely used in missile and aircraft component testing.

Still another variation of coupling is called water column testing in which a flowing couplant with a special transducer mounting uses a contained column of liquid.

In this way the immersion technique can be utilized without the necessity of large tank systems.

It must be remembered, however, that in any non-destructive testing method, the success of the test depends on the operator and how he interprets and analyzes the results.

Ultrasonics vs Radiography



by **John E. Bobbin**

Branson Instruments, Inc.

SINCE ULTRASONICS and radiography differ in their approach, it is reasonable to expect results obtained by each to differ somewhat.

Using both non-destructive methods on a single weld has not produced an exact comparison, defect for defect and size for size. But in actual practice comparable overall sensitivity levels have been obtained. Both will usually detect gross defects in a weldment.

Radiographs will provide considerable detail regarding very small flaws (porosity, small inclusions) particularly where their volume is great. But it depends on a variation in the overall density of the material, which may not always be sufficient to provide suitable results.

On the other hand, radiographs provide permanent records of the weld condition for future reference, or for collection of opinions for evaluation of any borderline case. Improved techniques have also reduced the delay between time and final evaluation.

With ultrasonics it is possible to test through relatively great thicknesses of material with negligible loss in absolute sensitivity. With the exception of a few stainless steels, weakening of ultrasound through distances involved has little influence on the test's success.

Angulated cracks or lack of fusion, however tight, can readily be found. And there is no delay before test results are known.

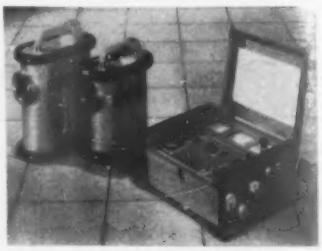
Ultrasonics is usually considered a low-cost test both from the reduced capital investment, as well as lack of recurring material expenses.

The problem of skilled reliable operators for interpretation of results is also being solved. Work is in progress to develop scanning and recording techniques aimed at reducing reliance on the human element, and to provide permanent records where desired or needed.

Since the two methods provide correlating refinements in non-destructive testing, they are not really competitive, but rather supplemental.

The latest NDT

New products



X-ray units

Two industrial x-ray units are completely self-contained, shockproof, rayproof and weatherproof for outdoor operation. Tube heads can be hoisted to remote areas for radiography on aircraft wing sections, welds, and steel components up to 2½-in. in thickness. Emergent beam angle is 50 deg and x-ray voltage is continuously adjustable under load in a stepless range. Load rating is 5 milliamperes at all voltages. Duty cycle is 100% continuous with water cooling — intermittent with air. Power requirements are 110, 220, 380, or 440 volts, 50/60 cycles. Automatic reset timer is built into the control unit. Operating temperature range is from −4 to +176 F. *Phillips Electronic Instruments*

Circle No. 1

Flaw detector

New type ultrasonic flaw detection unit, called Sonoray 5, is lightweight (37 lb) and measures only 11 x 7¾ x 20¾-in. in high. Picture shows unit probing a hollow steel cylinder for internal flaws, being checked for accuracy and resolution by means of a continuous recorder. *Branson Instruments, Inc.*

Circle No. 2

Radioactivity gage

Radioactivity measuring device can collect more than 600,000 counts per minute with accuracy in excess of 99%, has an extremely precise discriminator and will not "over count" due to pulse distortion, according to manufacturers. Odometer-type timer, accurate to within 0.02 of 1%, has been built into the scaler to match the counting performance. It will measure up to 999.99 in steps of 0.01 minute. Weighing 64 lb, unit stands 11¾-in. high, 20¾-in. wide and 14-in. deep. It has 11 pre-set time positions for preselecting statistical error, can be used with scintillation detectors, Geiger tubes, and proportional counters with preamplifiers. *Picker X-ray Corp.*

Circle No. 3

Spray materials

Magnetic particle inspection materials are available in pressurized spray cans and plastic squeeze bottles. Two styles of bath and one style of powder each contain one lb of magnetic particles, can be used with any magnetic particle inspection equipment or test kits in operation. *Magnaflux Corp.*

Circle No. 4

X-ray equipment

Equipment for all x-ray diffraction and fluorescence analysis techniques consists of two units: one for use with cameras where the diffraction pattern is recorded on film and the second for use with a diffractometer, in which a radiation detector is rotated around the specimen to pick up the diffracted beam. Electronic components include an automatic control for the diffractometer, a recorder that automatically draws a graph of the diffraction lines and another that automatically prints in numbers the radiation intensity. New diffractometer has set of gears that is accurate to within 3/10000 of one degree — nearly 100 times more accurate than any comparable equipment available, manufacturer states. *Picker X-ray Corp.*

Circle No. 5

Wristband holder

Wristband holder is designed to be worn on the palmside of the wrist, assures uniform exposure to all parts according to manufacturer. For use in handling of radioisotopes, especially beta emitters, and in lining up x-ray diffraction instruments, the holder is made to accommodate two filmbadges — one to check weekly exposures and one to be used as the 13-week badge. *St. John X-ray Laboratory*

Circle No. 6

Crack detector

Completely portable, magnetic crack detector is capable of identifying sub-surface as well as surface cracks, flaws and defects in any ferro-magnetic metal, says manufacturer. Unit weighs 30 lb, can be operated from a normal 110 volt a-c source or ordinary truck or auto battery. Designed for one-man operation, device is entirely controlled by one switch. Complete unit including probe, connectors, sprinkling bulbs, gray and yellow powder, is contained in sturdy steel carrying case. *United States Casting Repair Corp.*

Circle No. 7

AROUND

General Cable's rubber-insulated welding cable is so flexible you can run it almost anywhere. It provides excellent resistance to abrasion, twisting, impact, heat, moisture and weather. Our neoprene-insulated welding cable extends this durability by also resisting flame and oil. And for really heavy-duty use, our Super Service welding cable combines unusually-fine strand construction with a heavy-duty, mold-cured neoprene insulation-jacket. This Super Service type complies fully with all of the applicable IPCEA standards. General Cable also manufactures a superior Welder Power Supply Cable to complement its regular line of welding cables. Call your authorized General Cable Distributor for full information.

GENERAL CABLE CORPORATION

730 Third Avenue, New York 17, N.Y. ■ Offices and Distributing Centers Coast-to-Coast

PAIR of powerful permanent magnets connected by a flexible handle form this yoke for magnetic particle testing. Magnetic field is created across the weld being inspected. Interruptions in field, caused by hidden defects, attract powder, outlining irregularity.

DYE penetrant was used to check welds on radar installation. Indication shows transverse fatigue crack in aluminum welds.

WELD seam is inspected by fluorescent liquid penetrant method.

For surface and near-surface inspection, use penetrants and magnetic particles

SPEED AND SIMPLICITY are primary advantages of the two major non-destructive test methods used in detecting surface and shallow subsurface defects.

These are the magnetic particle and dye penetrant processes and their fluorescent counterparts.

Magnetic particle and fluorescent magnetic particle inspection equipment ranges from a simple powder bulb and hand yoke (see reproduction of cover photo on this page) to extremely sophisticated equipment that includes console cabinet components.

The process is adaptable to inspection of most magnetic materials. An intense magnetic field is set up in the proper direction within the weldment. A magnetic material—usually iron powder filings—is then applied to the surface. Sudden interruptions in the field caused by weld cracks or other defects will attract the flux on the surface to that area of defect.

The iron particles outline the exact shape and size of the crack or discontinuity.

A refinement of this dry particle test is the wet suspension method, wherein magnetic particles are applied in a suspension—usually thin oil or water. A further extension of this wet method uses fluorescent particles that glow under a black (almost ultra-violet) light.

For non-magnetic materials, a fluorescent penetrant method also makes use of the black light. But here the resemblance to wet particle inspection ends. In the penetrant system, the agent is an oil base substance that is capable of penetrating every surface defect. The black light reveals such defects in a sharp glowing contrast to a surrounding flaw-free surface.

The fluorescent penetrant—water-washable—is applied by dipping, brushing or spraying. After it has entered all seams (and cracks and pinholes—if any), the surface excess is washed away with a water spray. After drying, a dry powder of water-suspension developer is applied to create a dry powder film on the surface. This draws the penetrant up from the defect. Inspection is done under black light in a darkened booth.

Similar to the fluorescent penetrant process, dye penetrant inspection makes use of a simple-three step method. A cleaner is sprayed on the part and all dirt and grease wiped off; the penetrant is applied, with any excess being wiped off; then the developer is sprayed on. The developer, upon drying, draws the penetrant to the surface, just as in fluorescent inspection.

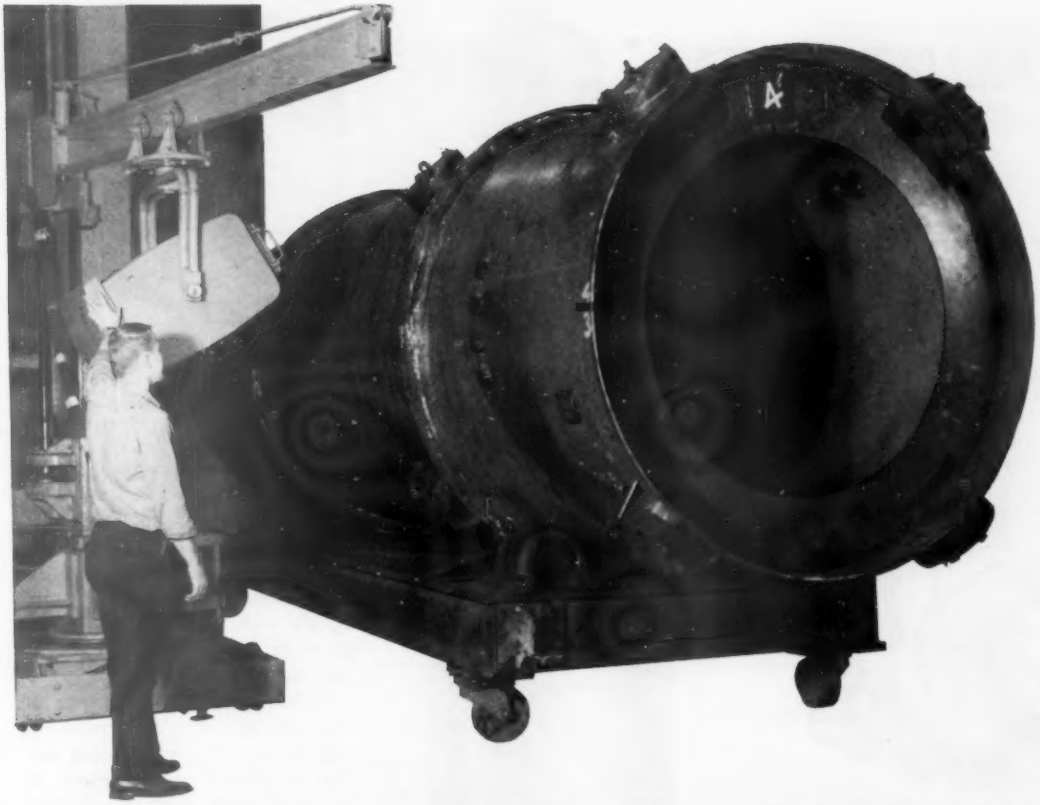
The difference is that the flaws will show up under natural light.

Many of the dye penetrant materials today are packaged in spray-type cans for ease of handling and application.

Several other non-destructive test methods should be mentioned here.

Eddy current testing developed when it was found that an a-c coil in proximity to a metal piece will induce eddy currents in the metal.

Such a current creates a magnetic field opposing that already in the metal. Impedance of the exciting coil is naturally affected by the eddy current that is set up, and whenever a defect exists in the



Undersea nest for a talented metal bird

This is the firing tube of the Navy's Polaris missile, made by Consolidated Welding and Engineering Company, Chicago, Ill. Every weld must be flawless. To make sure, more than 100 radiographs are made on each assembly.

Made of HY-80 plate with monel inserts, this firing tube presents difficult problems in welding dissimilar metals. But radiography, with Kodak Industrial X-ray Film, Type AA, checks the entire assembly for discontinuities.

Radiography provides the means of "seeing" internal conditions and supplies a lasting record of what is seen. It gives producers of welded products and of castings a means of making sure only high-quality work is delivered.

Would you like to know how radiography can help you? See an x-ray dealer or write us to have a Kodak Technical Representative call.

Read what Kodak Industrial X-ray Film, Type AA, does for you:

- Speeds up radiographic examinations.
- Gives increased detail visibility and easy readability at all energy ranges . . . because of high film contrast.
- Provides excellent uniformity.
- Reduces the possibility of pressure desensitization under shop conditions.

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Radiograph of weld on missile firing tube.

Kodak
TRADE MARK

MEETS RIGID SPECIFICATIONS

HARRISBURG CYLINDERS

Among the many reasons for longevity and dependability of Harrisburg cylinders are the rigid tests and inspections to which the cylinders are subjected.

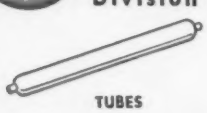
For example maximum control of cylinder wall thickness is attained through the use of an XactRAY Gauge. This instrument is used to measure wall thicknesses throughout the length of the cylinder shell. In addition to the XactRAY gauge; Vidigages, Sonigages and Magnaflux Testing are available for use as required.

These instruments, of course, are supplementary to exhaustive I. C. C. inspections and tests which make possible effective control of wall thickness for minimum weight consistent with maximum service life.

More than a Century in Harrisburg 8, Pa.

H HARRISBURG STEEL CO.

Division of HARSCO CORPORATION

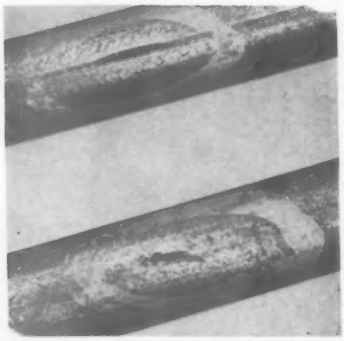


TUBES

TRANSPORTS

FLANGES

COUPLINGS



EDDY current was used to detect these end cave weld defects in pipe. (All photos courtesy Magnaflux Corp.)

metal, increased impedance can be measured.

In leak testing, water is still a popular medium. But in addition to hydrostatic, metals may be tested with fluorescent or radioactive liquids and gases, and by such gases as helium, freon, ammonia and sulphur dioxide.

Probably the most sensitive of leak tests is that which utilizes a detector sensitive to halogen gas. The gas placed under pressure in the part must contain chlorine, fluorine or any of the non-oxygenated radicals. Such a device is capable of detecting the presence of one part of a gas in one million parts of air.

Mass spectrometer detection in conjunction with helium is another sensitive set-up that will note one part helium in 200,000 parts of air.

"Sorry I wasn't at work yesterday, Boss. I drove down here but couldn't find a place to park."

Comparison chart of X-ray film

Film type	Trade name	Recommended applications
Fast speed High contrast Fine grain	Ansco Superay 'A' Gevaert Structrix D10 Ilford Industrial B	Thin sections or low-density materials, such as aluminum and magnesium alloys. Heavy sections or complete castings with lead screens at high voltages. Light alloy and steel castings and welds. Medium to fairly great thicknesses of heavy metal.
Fast speed High contrast Very fine grain	Gevaert Structrix D7	Medium and fairly great thicknesses of light metal or thin and medium thick objects of heavy metal. Also thick objects of heavy metals at high voltages.
Fast speed High contrast Extra fine grain	Du Pont Type 510	Thin sections of low-density materials at low voltages and steel up to 3-in. thick at high voltages.
Fast speed Medium contrast Fine grain	Ansco Superay 'D' Kodak Type F	Wide range of thicknesses with intensifying screen for heavy metals at low voltages. Steel, brass, etc. with limited kilovoltage machines.
Very fast speed High contrast Medium grain	Ansco Superay 'C' Gevaert Structrix S Ilford Industrial G	Especially suited to gamma radiography or production line work. Thick objects of heavy metal (bronze and steel castings) at low voltages.
Very fast speed Medium contrast Medium grain	Ilford Industrial A Kodak Type KK	Heavy castings in steel, bronze, etc., and for rough examination of steel welds. Also castings and assemblies having a wide range of thickness or density.
Medium speed High contrast Fine grain	Du Pont Type 506 Ilford Industrial CX Kodak Type AA	Light metal castings requiring fine detail and critical examination of steel welds up to 1¾-in. thick. Light metals at lower voltages and heavier steel parts at higher voltages.
Medium speed Extra high contrast Extra fine grain	Gevaert Structrix D4	Thin to medium thick objects of light metal at normal voltages, and thick objects of light metal and thin objects of heavy metal at high voltages.
Moderate speed High contrast Fine grain	Ilford Industrial C	Light metal castings requiring fine detail and critical examination of steel up to 1¾-in. thick.
Moderate speed Extra high contrast Extra fine grain	Gevaert Structrix D2 Ilford Industrial F	Thin or medium thick sections of light metal at low or medium voltages when fine detail is required; allows use of higher-than-usual voltages without loss of contrast.
Moderate speed Very high contrast Extra fine grain	Ansco Superay 'B' Kodak Type M	Light metals requiring highest quality definition; also for high voltage gamma and X-radiation.

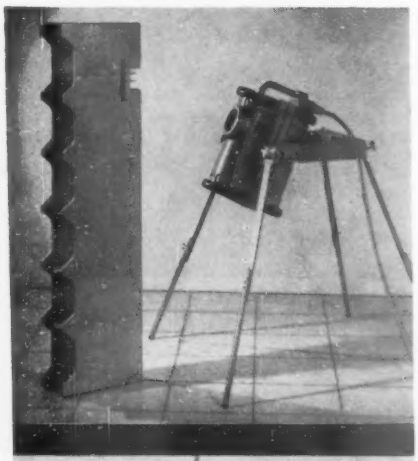
Who Wants Ordinary

There is no magic in industrial radiography. Any X-ray unit in working order will produce radiographs — most of which will be good radiographs. But, if you want to produce unexcelled radiographic results of a quality you would hardly believe possible . . . you've got to go Norelco.

The new Norelco portable X-ray units

PG 140 and PG 200

actually guarantee unsurpassed radiography



HERE'S WHY!

Norelco achieves high definition through meticulous design coupled with the improvement of several basic precepts.

HERE'S HOW!

Small Focal Spot Size

This feature is an absolute essential to hold detail-destroying penumbra to a minimum — of special significance when the part to be radiographed is not in contact with the film.

Wide Range — Continuously Variable KV

Optimum kilovoltage is necessary for any wide variety of materials. Adequate film densities can be reached only with equipment possessing this feature.

Highest Possible Milliamperage

Maximum focal-film distance, consistent with a reasonable length of exposure, is always desirable to reduce image unsharpness. Under-powered equipment leaves no option here.

100% Duty Cycle

Even lightweight, compact, portable equipment should provide the option of water cooling so that it may be run continuously. Production rates are often hampered by the intermittent duty cycle characteristics of air-cooled equipment.

RADIOGRAPHS?

So, if you want modern results which will do more than meet your every expectation, learn more about Norelco's new PG 140 and PG 200 Industrial X-ray Equipment.

It's easy, simply phone or write your nearest Norelco representative. He will be pleased to answer questions and even arrange for a demonstration of this superb equipment.

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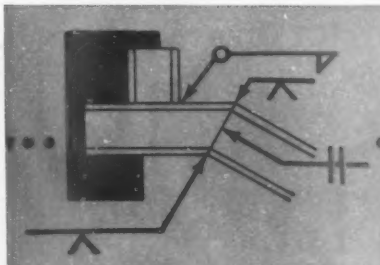


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

How to avoid defective gas welds

Question:
Last month (May, WE) you detailed the fundamentals of oxyacetylene welding. Could you outline how to avoid defective welds when using this process?

Answer:
Defective welds are the result of improper welding methods. Most of the difficulties encountered in welding may be attributed to doing some small thing incorrectly. The common defects are those which follow.

Incomplete welds — An incomplete weld, commonly referred to as "lack of penetration," is one of the most frequent faults, particularly for the new weldor. It usually results from an edge preparation difficulty. The parts to be welded may be spaced too closely or the edge bevel may be incorrect.

A weldor may be deceived by the fact that weld metal is dripping from the underside of a joint; this is not proof that a complete weld is being made. For example, some areas in a weld joint may be complete – welded from top to bottom — while in other places this is not the case.

In these latter spots the filler metal may be separated from the face of the bevel by an oxide film which prevents fusion. Incomplete welds show up readily when tested: they are weak and will not stand as much bending or pulling as the base metal.

Undercutting — Though the weld may be perfectly made, undercut occurs when the flame has been improperly manipulated. As a result, a portion of the base metal alongside the weld is melted away. This reduction in thickness of the base metal weakens the joint. Watch the work carefully to see that neither side of the seam is undercut during the welding operation.

Poor fusion — This defect is evidenced by failure to get clean, sound metal deposited throughout the weld. The flaws shows up in one of four forms: laminations — successive layers deposited in the joint without thorough fusion of each layer; overlap — when the molten metal or puddle is allowed to flow ahead along the weld joint before the base metal has been thoroughly melted; slag inclusions — the result of welding on dirty metal or with dirty filler rod, without taking precautions to work the slag to the top of the molten pool; and oxide inclusions — when oxides remain in the weld puddle, weakening the weld in the same way as slag inclusions.

Oxidized and carburized welds — These are caused by using a flame with an excess of oxygen or acetylene. Weld metal that has been oxidized looks burnt; a carburized weld contains small holes and radial lines extending from the center of the bead toward the outside. Both welds are weak and brittle. Sometimes it is impossible to maintain a neutral flame because something is wrong with the regulators or torch.

Hard spots — Cast iron welding is often made difficult by the occurence of hard spots in the weld. Usually they are not visible on the surface of the bead though occasionally there is a small silvery grey spot which indicates such a formation. A very undesirable kind of fault, hard spots are the starting point for progressive cracks. They are caused by a sudden chilling or cooling of the weld metals such as putting a cold welding rod into the molten puddle.

Hard spots which show up on the surface as silvery areas may be formed by going over the top of the weld after it has cooled, or remelting small areas which become chilled from cold metal underneath. To avoid hard spots be sure the parent metal is kept hot and that a large molten puddle is maintained. It has been found that ripple type welding is less apt to produce hard spots than a procedure that calls for successive puddles.

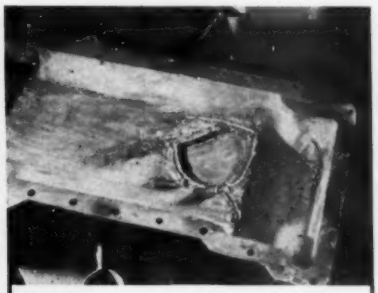
Blow holes — When these appear on the surface it is fairly certain that they will also be present in the interior of the weld. Formed by gasifying particles of foreign material present in the parent metal or filler rod, they may be avoided by watching the puddle and floating bubbles out as they appear.

Another obvious welding defect is the failure to maintain a full size weld bead to the end of a seam. This careless act will result in a crater or depression which may easily cause cracking or the complete failure of the weld. Such a fault can be overcome by practice in manipulating the pool or molten metal at the end of the weld.

NEVER SAY "CAN'T WELD IT"... Case in point: Midwest shop was given a broken cast iron oil sump to repair. Conventional weld attempts failed due to oil and crack-sensitivity. Porosity and voids resulted. Then they called in Eutectic. Our man-on-the-spot prescribed the cure: our trouble-shooting trio of ChamferTrode®, EutecTrode® 27, and QuenchTrode* 24. Watch them!

1.

Weldor vees out area with Chamfer-Trode, and makes grooves in side of vee to relieve stress.



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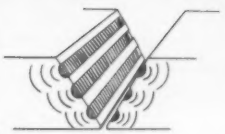
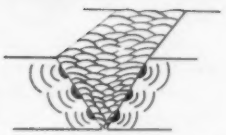


Now he "paints" over entire vee surface with EutecTrode 27, filling grooves as he goes. EutecTrode 27 bonds to the oiliest surface, gives base for joining.

3.



Final step: weldor makes joint with QuenchTrode 24, using stringer passes and cold-to-hot back-step method. He quenches with wet rag after each pass, till complete fill is made.

RESULT: A strong, permanent, machinable weld, in a fraction of the usual time. No distortion, stress, or cracking. NOTE: the "Quench Weld" process is equally effective for building up missing metal sections or joining steel to cast iron. This is but one example of how Eutectic helps you.

For the finest in quality products, always turn to Eutectic. Service, on the job, any time, anywhere.

O.K., Eutectic, Prove It!
I want a demonstration of the Quench Weld Process.

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Company .....
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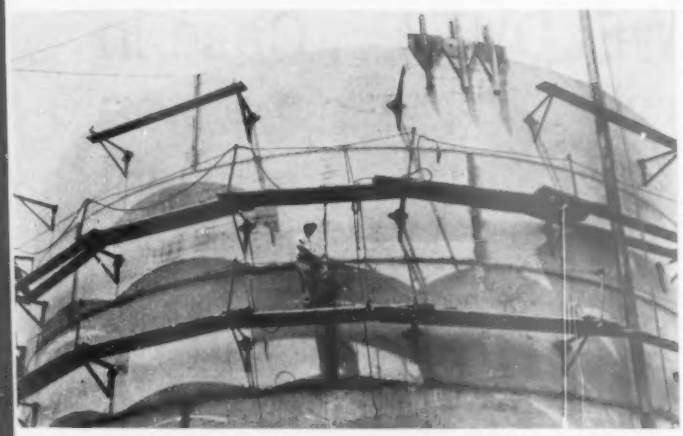


PORTABLE X-ray has a three-fold mission at Fisher Tank Co. Welder qualification tests are now conducted with these units, supplanting old procedures. Structural attachments and parts of field erected tanks are X-rayed prior to delivery and all weld seams of field erected storage tanks are inspected during construction both on a spot and continuous basis.

LOW pressure, 20,000 barrel ellipsoid vessel constructed by Hammond Iron Works, Warren, Pa., made use of X-ray weld inspection. The firm erects specially-designed tanks, process vessels, towers and other steel plate construction for the petroleum, chemical and other process industries.

Portable X-ray units see duty in many applications

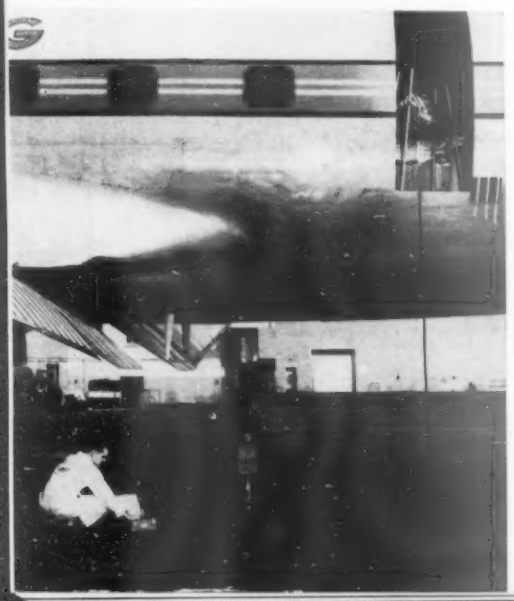
PORTABLE X-RAY UNITS have become standard, dependable non-destructive testing tools for checking weldments in a multitude of industrial applications.

They are being used advantageously, and in some cases exclusively, by aircraft builders, ship owners, steel structure experts, tank fabricators and testing laboratories.

Illustrating the versatility of a portable X-ray unit are the four applications shown here. These are but a few of the many recorded by Balteau Electric Corp., Stamford, Conn., during the past year.

In that time, the firm's X-ray units have inspected a gamut of technology from ocean depths (atomic submarines) to outer space (missiles).

STEEL globe houses reactor for Yankee Atomic Electric Co. plant in Rowe, Mass. The 125-ft-diameter sphere, being erected by Chicago Bridge & Iron Co., is set on eight reinforced concrete columns and 16 steel pipe supports. Portable X-ray units are being used for sample checks as well as for 100% radiography requirements.



CRITICAL door frame of passenger aircraft is radiographed with portable unit at Lockheed Aircraft Service in New York's Idlewild Airport. When aircraft has been subjected to stress damage during a turbulent flight or hard landing, unit can search and determine extent of injury.

NEW ANSCO X-RAY SAMPLES tailored to your needs

Free on request

Ansco

Industrial X-ray Materials

Interested in improving your overall radiographic quality? Here's your opportunity! This new Ansco X-ray Sampler will be tailor-made to suit your needs in both film and chemicals. So just fill in and mail the coupon. Soon you'll be testing the best . . . Ansco!

FREE! Illustrated booklet of case histories where radiography and photography have helped increase business efficiency. Wouldn't you like a copy for yourself? See your Ansco representative. Ansco, Binghamton, N. Y., A Division of General Aniline & Film Corporation.

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YES! I want to make a critical test of Ansco Industrial X-ray Materials. Please provide additional information on how to obtain a X-ray sample kit.

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G

INSIDE section of welded steel pipe is X-ray head of continuous fluoroscoping inspection unit.

Fluoroscopy gets "inside" pipe

A CONTINUOUS fluoroscoping process is working to reveal hidden flaws or defects in seams of welded steel pipe used in oil and gas transmission.

The process, in operation at the site since January, 1959, is being used at the McKeesport, Pa., plant of National Tube Div., U. S. Steel Corp.

Pipe welds formerly were checked by X-ray, but only the end portions of each pipe section received this treatment. Even for this limited area, X-ray inspection was much slower.

The fluoroscope unit consists of an X-ray head which casts a shadow image of a weld on the fluorescent screen of an image intensifier. The image is electronically intensified and picked up by a television camera. The picture, greatly enlarged, is then viewed by an inspector on a monitor screen.

In operation, 40-ft sections of welded pipe are placed on a carriage which passes in front of the inspection booth. The X-ray head, mounted on a 48-ft boom, fits inside the pipe in line with the welded seam.

Inside the booth, the inspector stands at a control panel which permits him to position the pipe and control its lateral movement. He can slow or stop the carriage instantly for prolonged examination of any portion of the weld. If a flaw is detected, he marks the spot by pressing a button which releases a spray of water-soluble white paint on the pipe.

The Most Advanced Line of Welding Aids Ever Produced for

PIPE-LAYOUTS of ANY Type or Location

CURV-O-MARK

CONTOUR MARKERS

Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Marks all around pipe—saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diam.

CURV-O-MARK

CENTERING HEADS

Really, 5 tools in one—it replaces Protractor, Centering Head, Center Punch, Level and Scale. Eliminates difficult measuring, checking and marking. Pocket size—weight only 9 ozs.

CURV-O-MARK

RADIUS MARKERS

Has marking span of 24" and swings to 48" circle or arc. Pencil holder accommodates round or flat pencils, soapstone and steel points. Unequaled for accurate layout work. Wt. 8 oz., pocket size.

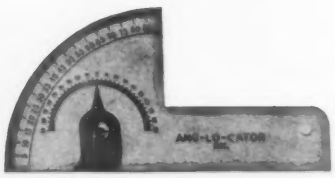
CURV-O-MARK

PIPE FLANGE ALIGNERS

For Aligning Slip-on, Top Joint, Stub End and Welding Neck Flanges. This self-centering Tool is quickly adjustable for all types of Flanges or Pipe sizes from 3" to 12" in diameter.

CURV-O-MARK

Ang-Lo-Cator Protractor



An easy way to find accurate angles on pipe and structural material. A valuable aid to weldors, structural workers and pipe fitters. Size 4" x 8"

Your Welding Supply Dealer Recommends all CURV-O-MARK Products

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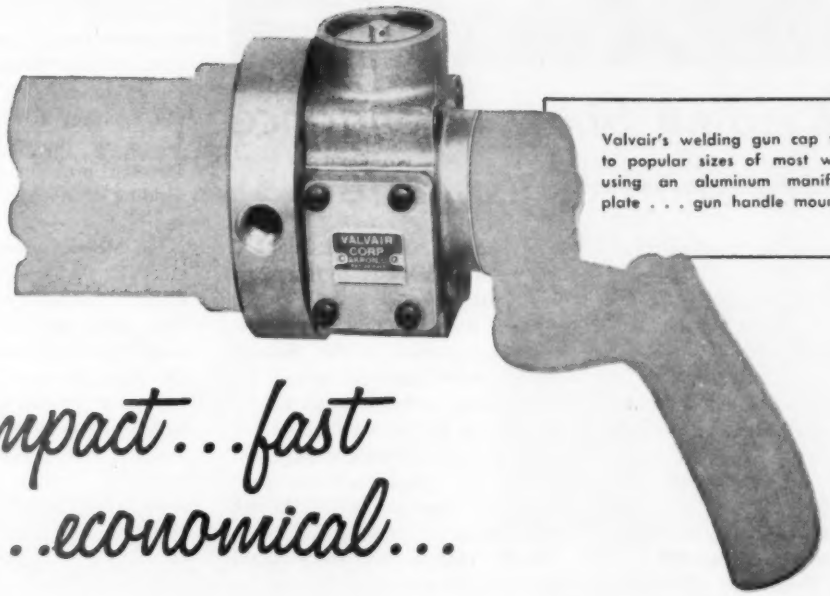
VALVAIR'S®

WELDING GUN CAP VALVE



Valvair's welding gun cap valve adapts to popular sizes of most welding guns, using an aluminum manifold adapter plate . . . gun handle mounts on valve.

compact...fast
...economical...

Eliminate unwieldy multiple hoses . . . eliminate operating lag caused by long exhaust lines . . . eliminate excessive air consumption associated with remote-mounted valves and lengthy hoses . . . eliminate surplus weight and difficulty in working in confined areas caused by cumbersome clamp-on control valves at the gun — switch to Valvair's integrally-mounted welding gun cap valve.

Sandwiched between the gun cylinder and the handle, Valvair's cap valve exhausts directly to atmosphere . . . provides split-second response for better welds and higher production rates.

Requiring only air supply and power lines, Valvair's cap valve makes the gun more manageable . . . cuts operator fatigue. Aluminum construction keeps total gun weight low, too.

The Valvair welding gun cap valve is built around Valvair's standard SPEED KING solenoid coil, guaranteed against coil burn-out for the life of the valve. It employs Valvair's user-proved design, with a pilot-operated stem floating in O-rings and provides the performance and trouble-free service users have learned to expect from all Valvair products. Coils for ac or dc, any voltage; mounting adapters for original installation or field conversion of popular welding gun makes and sizes. Your nearby Valvair or Bellows Field Engineer has all the facts.

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For more information, write for free Bulletin SVA-5. Address: Valvair Corporation, Akron 9, Ohio, Dept. WE-660.

Valvair AKRON 11, OHIO

Other INDUSTRIAL DIVISIONS of IBEC: The Sinclair-Collins Valve Co. The Bellows Co., Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio.

APRIL was also National Welded Products Month and Absco, Inc., a Los Angeles welding supply distributor, made good use of its window display area to publicize the fact.

LA Welding Show attendance falls far short of estimate

NEVER HAVE SO MANY exhibited for so few.

This is, in a nutshell, the one disappointing item of the 41st annual AWS Meeting and Welding Show held in Los Angeles.

Official AWS attendance figures indicate a registration of 9,033 at the show, with an attendance count of around 11,000—still a far cry from the highly optimistic 25,000 estimate of early April. Meeting registration was 923.

In recent years, this attendance compares with the 1958 meeting and show in St. Louis, a smaller city, where show attendance was approximately 9,000, and total meeting registration reached 1,389.

In any event, the 132 exhibitors set a new record, one which may not be broken for quite a number of years to come.

"Where do we go from here?", an address by out-going president C. I. Mac Guffie, opened the annual convention on Monday.

Calling for continued service, planning and programing by AWS, he stated the society's growth in coming years will depend on the initiative taken in information and educational activities. And these efforts must be directed to, and reach, four groups: the youth in high schools and secondary schools; those studying engineering in college; the engineering profession itself; and the general public.

After the president's address, 31 of the welding industry's leaders were honored with 19 national and 12 regional awards. Among the recipients were:

B. E. Rossi, editor of AWS *The Welding Journal* — the Samuel Wylie Miller national award for outstanding contribution to the advancement of the welding art.

Dr. Robert D. Stout, department of metallurgy, Lehigh University—the Adams Lecturer certificate and honorarium.

R. D. Thomas, Sr., Arcos Corp., and R. L. Plummer, AWS national secretary—honorary memberships.

K. R. Notvest, Willamette Iron and Steel Co.—the Lincoln Gold Medal award.

J. E. Dato, Linde Co., and F. W. Davis, Southwest Research Institute—the National Meritorious Service awards.

F. C. Bundy and C. S. Matlock (Texas Highway Dept.), A. M. Hill and F. W. Zilm (Service Pipe Line Co.), and G. M. Sommer (Clearing Div., U. S. Industries, Inc.)—A. F. Davis Silver Medals.

Harry Schwartzbart, Armour Research Foundation — Educational Lecturer certificate.

W. H. Bruckner (University of Illinois), A. E. Flanigan (University of California), R. B. McCauley (Ohio State University), G. S. Schaller (University of Washington) and R. A. Wyant (Clarkson College of Technology)—first award of the Adams Memorial Memberships for advancement of welding technology.

NATIONAL Meritorious Service awards went to F. W. Davis, Southwest Research Institute and J. E. Dato, Linde Co.

On Monday evening, president-elect R. D. Thomas, Jr., Arcos Corp., greeted AWS members, their wives and guests at the annual Presidents reception held in the Hotel Biltmore's Galeria.

During the rest of the week, 71 technical papers by more than 130 authors were presented at the 29 technical sessions, four of which were co-sponsored by ASME's Metals Engineering Division.

At the Welding Show in the Great Western Exhibit Center, visitors viewed the more than $3 million worth of welding equipment, products and accessories for three days.

New electrodes, rods, brazing wires, positioners, a-c and d-c welders were among the products displayed for the first time by manufacturers. (Watch WELDING ENGINEER for complete reports on these and various other new products.)

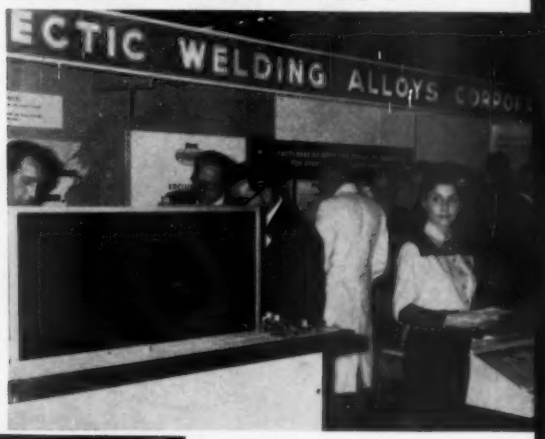
Two contests were held during the show, one by Metal & Thermit Corp., and a second by Fibre-Metal Products Co.

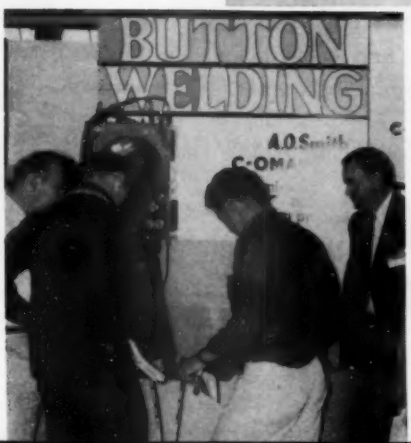
Winner of M & T's 1960 automobile was J. R. Peterson, lead man, Marquardt Co., Van Nuys, Calif. Fibre-Metal's three winners of transistor radios were: Joseph Rogers, Midstate Welding Supply Co., Hanford, Calif.; W. F. Brown, General Electric Co., Cincinnati; and Glenn Winston, North Hollywood Concrete & Tile Co., North Hollywood, Calif.

VIEWING sculpture in the welded products exhibit are Douglas Latimer, Jr., Baton Rouge, winner of this year's high school science project, and A. L. Collin, chief development engineer, Kaiser Steel Corp., Los Angeles. At right, C. L. Malott, Miller Electric Mfg. Co., Inc., discusses a technical point with Robert Habib, an electrical engineer from Sao Paulo, Brazil.

Scenes from the Show

DR. C. G. Keel, this year's IAA Morehead Medalist, stopped at WE's booth to chat with managing editor Greg Cannizzo.





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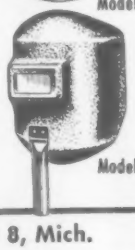
PLANTS: Keokuk, Iowa; Pryor, Oklahoma; and Shawinigan Falls, Quebec, Canada

King Arthur claims:

"I don't jest when I joust, no foolin' Dockson HELMETS are ye best for protection and comfort."

Complete, comfortable protection against sparks, flash and dangerous rays. Light, roomy, adjustable, easy, one-hand raising. Stays where you want it.

Built to last of tough, one-piece, rivetless, moulded fibre.



Dockson CORPORATION

There's a style to suit your need. Write for catalog 56-06.

3839 Wabash Ave., Detroit 8, Mich.

Liquid flux cuts bracket weld time

FABRICATION and chrome plating of 3,000 brackets to hold emergency storm shutters for a 70-store chain in the Southwest was meeting difficulties.

Problem: slow production and plating difficulties had raised costs.

Solution: a liquid fluxing system designed for production brazing.

At first the firm's chief utility weldor and fabricator decided to make the brackets in the company shop. Cutting the parts and welding steel tubing to the 1⅛- x 3-in. steel plates posed no particular problem. He soon found, however, that using a flux coated rod applied by torch made the job a slow one and did not provide welds clean enough for plating.

The firm called in a representative of Alloy Weld Supply Co., Houston, who recommended an automatic fluxing system made by All-State Welding Alloys Co., Inc., White Plains, N. Y.

In this system, the vapor entrained flux is fed in controlled amounts with acetylene through the flame of the torch. Specifically recommended was a nickel silver brazing alloy which flows at about 1,715 F and produces joints of 70-80,000 psi tensile and 120-160,-000 psi shear strength.

Production was speeded and the resulting welds were clean enough that the brackets were ready for chrome plating immediately.

WELDOR uses automatic fluxing system to feed vapor entrained flux automatically to the job.

they turn in top performance to turn out top results

improved grinding action and longer wheel life for faster weld grinding... SIMONDS NEW SERIES 60

DOUBLE XX

Reinforced Resinoid

DEPRESSED CENTER WHEELS

Better than ever for long wheel life . . . faster by far for economical weld grinding. This efficiency is yours with Simonds Series 60 Double XX Wheels. New manufacturing methods give this new series of reinforced resinoid bonded wheels superior grinding action. Each wheel has maximum amount of abrasive grain. Doubly reinforced for extra strength and safety. Lightweight rigid type for general use. Unexcelled for grinding welds. You can also get slightly flexible Fibrex Wheels for lighter jobs and stainless steel. Order from your Simonds distributor.

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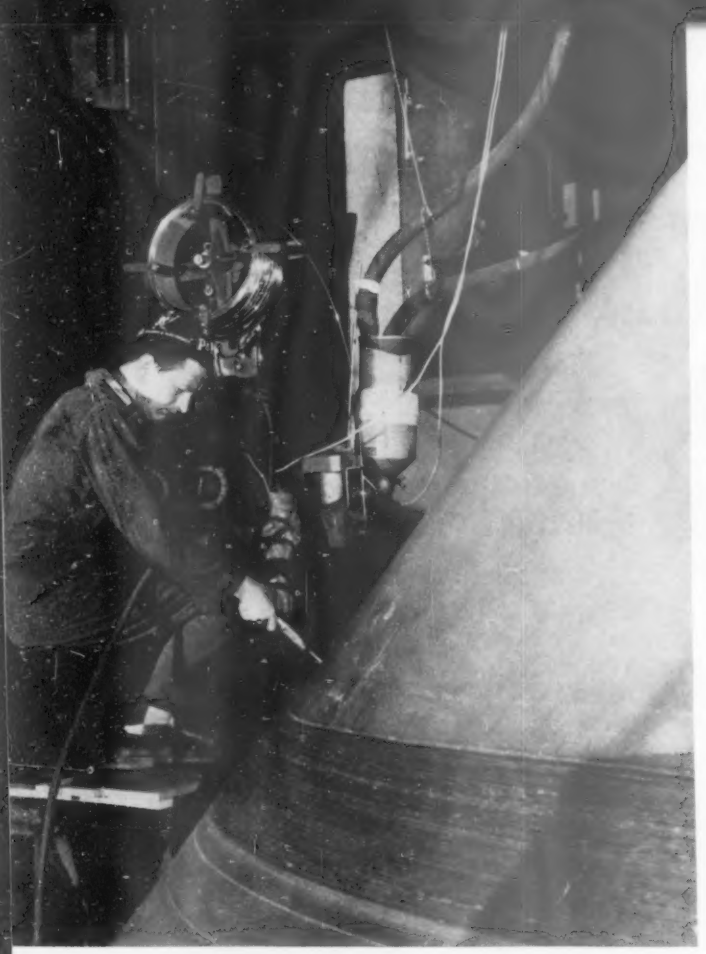

OPERATOR builds up worn areas of blast furnace bell before hardfacing operations.

Large savings claimed in blast furnace hardfacing

BASIC STEEL FIRMS may be able to save thousands of dollars annually through a technique of fully restoring, and at the same time increasing wear life, of heavy cast steel blast furnace components.

The technique, developed by the Steel-weld division of R. C. Mahon Co., Detroit, involves hardfacing specific portions of the parts, but encompasses a combination of metalworking procedures dictated by shape — fixturing, grit blasting, heating, welding, machining and balancing.

The method is estimated to at least double the service life of bell and hopper sections when handling ordinary iron ores, and equal present life when subjected to the much harder taconite and sintered ores.

(*More than a year ago, the editors of WE were told by a salesman of hardfacing alloys that the use of taconite by steel mills had cut previous normal service life of blast furnace bells. Following through on this tip, we called several steel companies to get the story. But all our contacts denied the "rumor." Obviously, they were reluctant to talk. . . for reasons best known only to themselves.*)

The bell and hopper, located at the top of the blast furnace, are constantly exposed to terrific sliding wear daily in receiving ores as they are tippled for melting.

According to Mahon engineers, the biggest problems faced in developing the technique were:

1. Working out proper temperature for preheating, and maintaining the right amount of heat on the work to prevent cracking during hardfacing. It was found that the body metal of the work had to be conditioned to a temperature that would minimize thermal shock when applying the hardfacing metal by welding, then cooled gradually, after the deposition procedure.

2. Developing the proper angle of applying the weld metal to provide an ultimate surface hardness of 45 to 50 Rockwell C.

3. Finding the proper rate of weld metal deposition to end up with a very smooth surface.

Made of about 0.70% manganese, 0.33% carbon, and 0.8% silicon steel, the bell costs roughly $45,000 to replace as a new component. Weighing 33 tons, it has side walls 3-in. thick. From the floor, it tapers on a 53 deg angle to a height over 9 ft, and is 16½-ft in diameter at the "mouth" end. Service life of the part normally is about 2 to 4 years.

Reconditioning under this procedure starts with cleaning by grit blasting. Then worn areas — as much as 5/8-in. deep — are built up to original thickness.

By suspending the huge part about 2 ft off the floor, it is possible to assemble a large, perforated pipe ring — to conform with the circumference of the mouth end near the floor — for directing gas heat upward on the wall edges. Open flames are used, and about 8 to 12 hours are required, under controlled conditions, to bring the unit up to, and maintain a temperature of, about 400 F.

The bell is hardfaced only to a height of 6½ ft from its large-diameter end. A standard automatic submerged arc welding machine is employed. To finish with a surface harness of 45 to 50 Rockwell C, a medium-carbon steel wire (for which the suggested classification is ER55-St) is used with metal (¼-in. thick) being deposited at the rate of about 33 inches per minute.

A single pass is made over the entire area marked off for hardfacing, except near the edges of the mouth end. Here, a double pass is made to allow for close tolerance machining, since this portion of the bell must make a gas-tight fit when assembled for service.

. . . more than one firm finds process useful

IN A SEPARATE, but nearly identical application, engineers at Columbia-Geneva Steel works of U. S. Steel Corp., Provo, Utah, are relining and enlarging a 30-ton furnace "bell."

Located near the top of the furnace, dual steel bells hold charged coke, limestone and iron ore before dumping them into the furnace body. Because the two bells are never open at the same time, they serve to

contain furnace pressures, somewhat like the revolving doors in an air-conditioned building. In this process, the bells — 15-ft in diameter at the wide end — are subjected to temperatures from 450 to 650 F.

Columbia - Geneva's solution to increasing their resistance is submerged-arc welding more than 3,200 lb of stainless steel in three separate layers to the outer, wear-exposed portion of the bell. During round-the-clock operations, the bell was kept at a constant 350 F and slowly rotated while the stainless "beading" was added in overlapping 1½-in. strips.

Special welding equipment and automatic controls were designed and built at Geneva to impart a thickness of 5/16-in. on the lower 7 ft of the cone. The new hardfacing process, in addition to extending the bell's service life, will make possible renewal of worn out bells for additional use.

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he'll explain how

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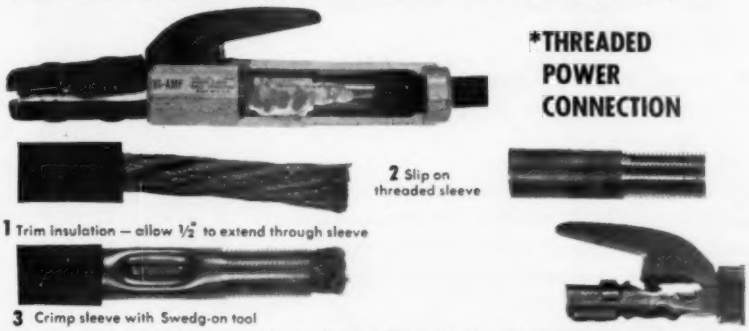
*THREADED POWER CONNECTION
2 Slip on threaded sleeve
1 Trim insulation — allow ½" to extend through sleeve
3 Crimp sleeve with Swedg-on tool

Screw sleeve into cable socket. (The ½" of cable strands will be forced against the holder tong member which gives another point of direct contact for good connection.)

Write for FREE booklet "Reducing Costs By Proper Care Of Arc-Welding Circuits"

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CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

Resonance bending tests pipe fatigue

YEARS OF STRESS and strain encountered by metal pipe is being compressed into minutes in order to determine the pipe's approximate service life.

Lengths of pipe, set to vibrate in their natural resonance frequency, literally shake themselves until they crack from fatigue failure, according to Tube Turns Div., Chemetron Corp., Louisville, Ky.

The forced vibration comes from eccentric weights spun by an electric motor, readily achieving cycles of several thousand vibrations per minute, *e.g.*, carbon steel pipe with half-inch thick walls can be vibrated to fatigue failure in less than half an hour, duplicating years of service life.

Though not a non-destructive testing method, resonance bending, however, is five to six times faster than mechanical cyclic bending or pulsating application of water pressure. From a standpoint of power requirements, manpower, equipment investment and maintenance, it is substantially more economical.

Steel pipe is first cut to calculated lengths of about 10 ft and then suspended freely from an overhanging steel beam. When locked in on a natural harmonic frequency and vibrating freely, amplitude of vibration is adjusted. Amplitude can be observed on a sine curve reproduced on an oscilloscope.

Pipe ends are sealed and the pipe is put under 10 psi air pressure during testing. When the fatigue crack develops, air leaks out and a drop of one psi causes an automatic switch to shut the drive motor. This provides accurate measurement of the number of cycles needed for failure.

Resonance bending may have possible extensive application in rapid determination of fatigue life of new metals and alloys as they are developed for nuclear and space travel piping requirements.

why it'll pay you to see PICKER *first*

about radiographic inspection problems

here you get **exactly the right machine**—x-ray or isotope*—to handle your problem best (x-ray is better for some jobs, isotopes for others). Nowhere else can you find anything even approaching the range of radiographic equipment Picker offers (*see index below for some idea*)

here you get **topflight local service** - the dependable facilities of the nationwide Picker X-Ray service network. Right in your own backyard there's probably a local Picker office with service engineers constantly on the job to keep your equipment running at peak form.

here you get **expert counsel** on *anything* and *everything* having to do with radiography or fluoroscopy. We'll test radiograph your own product and come up with recommendations. Advise you on exposure technics: plan and supervise shielded installations—go the whole way *with* you, *for* you. We even offer a training course on Basics of Radiography: it comes free with the purchase of Picker equipment.

all this at your command by simply calling your local Picker office (see 'phone book) or writing Picker X-Ray Corporation, 25 South Broadway, White Plains, New York.

*e.g. *for in-the-field radiography of steel up to 2" thick (e.g., pipeline work)*

here's a case in point

TECH/OPS 499 10 curie Ir 192 (5.5 RHM output)
Practical for steel up to 2" thick.
Will radiograph full girth weld of inch-thick 8" diameter steel pipe in four minutes.
Travels snug-packed in sturdy fiberglass case.
Weighs only 58 lbs. complete, ready-to-go.
Price $1375 complete (without source).
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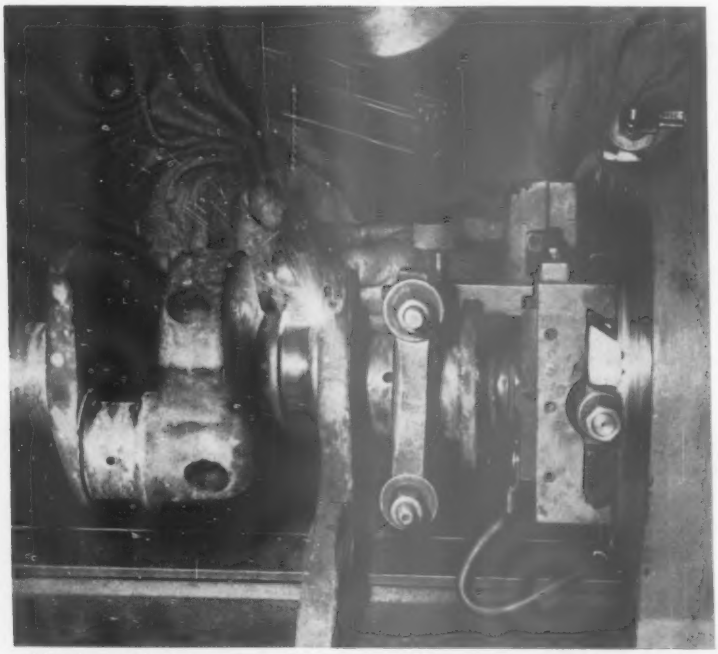
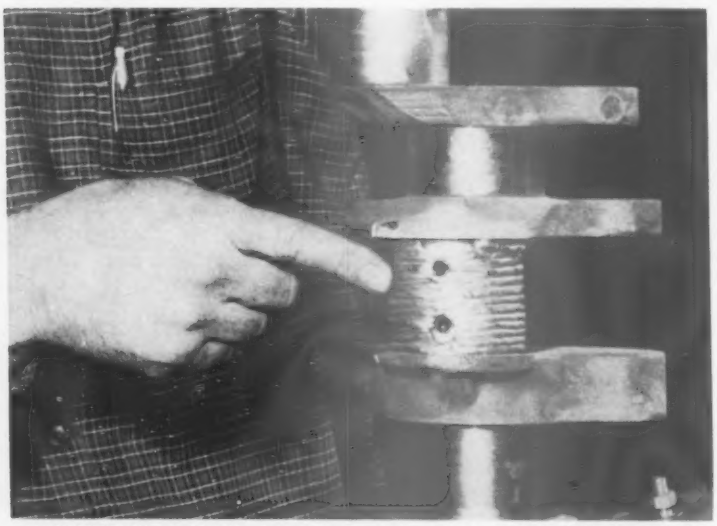
no capital investment if you'd rather rent ● ask about the PICKER RENTAL PLAN

CO_2-Mig used to advantage in crankshaft rebuilding

. . . low-heat, rebuilding technique saves time, money for California firm



WORN crankshaft journal undergoing Mig welding. Shaft is rotated in a lathe at 2 rpm uphill.



COMPLETED Mig weld with deposit built up around edges of oil hole. Crankshaft is now ready for grinding.

WHILE NEW CARS are naturally equipped with new crankshafts, almost all replacement crankshafts are exchanges whose worn bearing surfaces are built up to oversize and ground down to desired tolerances.

In the past, the build-up has been accomplished mainly by a metal spray process using oxyacetylene flame to melt a special wire which is blown onto the metal shaft surface by compressed air.

A faster and less costly method has been introduced by a southern California distributor for Linde Co., New York City. The method makes use of short-arc welding—a low heat input CO_2-Mig welding process.

All these features are valuable when the process is applied to crankshaft rebuilding. It deposits a steel bond on the shaft which is equal to the shaft in density. Actually, the alloy of the shaft mixes with that of the welding wire to form a homogeneous deposit which blends with the original metal.

All or part of the worn bearing surfaces can be rebuilt into a full fusion weld, which eliminates any tendency to chip or loosen. Low heat minimizes distortion.

At the Thomas Engine Corp., Pasadena, Calif., it formerly required 20 to 30 minutes per rebuilt shaft, about 15 minutes of which were for preparation of the metal surface for spray. Each shaft is now completed in 3 to 5 minutes. There is also an approximate 30% time saving in the finish grinding operation due to the ease of reaching desired tolerances made possible by short-arc build-up.

Consumables formerly cost about $1 per built-up journal, whereas present cost has been slashed to 23 cents per journal. Distortion is held to less than 0.005-in. Average production of rebuilt crankshafts at Thomas has jumped from 12 to 16 units per day to 30 to 35 units.

Basic equipment includes high-tensile spooled steel wire 0.030-in. in diameter, argon-carbon dioxide mixture (75%-25%), and constant voltage welding power unit with slope control and 300 amp capacity.

Compactness comes to welding...

A. O. Smith's new MONARC line compacks more machine in a smaller package at a smaller price

400 AMP model shown—all models same size.

Compactness comes to welding...

Customized accessories available including D.C. conversion

A. O. Smith's new MONARC line

trims the waste from welding machines

No waste of space!

It stacks! It racks! It slides under a bench with the greatest of ease. Only 28 inches low . . . 24 inches wide . . . 30 inches deep—the **MonArc** fits where others take up valuable floor space. You release area for increased production — an important factor with industrial space cost averaging $10 a square foot. We achieved this compact design without compromising superior welding characteristics of the moving-coil machine by making coil movement lateral.

No waste of motion!

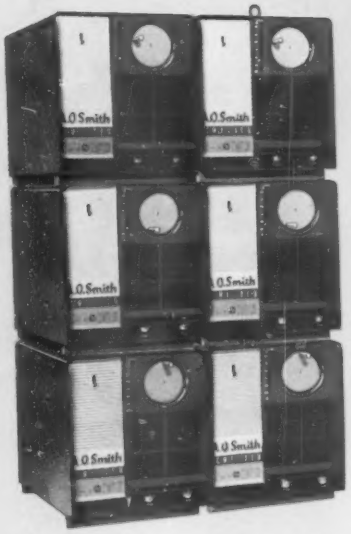
We made time and motion studies. We learned how to achieve compactness with no sacrifice in operational ease. For example, while the **MonArc** is a *foot lower* than conventional machines, the full-range, stepless current-control wheel is at convenient arm's length—higher than competitive models. We also cut down handwheel turns to 15 — fewer turns and easier turning than with any other standard characteristic welder in the market.

No waste of money!

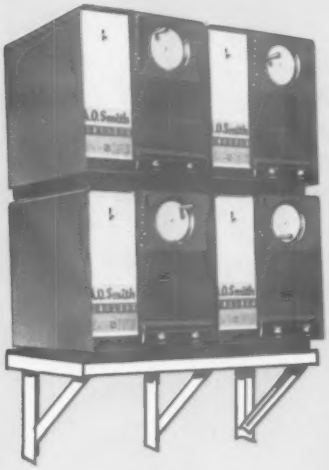
Superior in design. At an economical price, no other machine gives you so much for your money. But while you get more, you never get more than you want. The **MonArc** line consists of three basic machines (300, 400, 500 amp models). We customize this basic line with a selection of tailored accessories. You check off exactly what you need — no built-in "excessories" that add only cost to your operation.

No waste of time!

Our customized approach also saves on delivery time. You don't have to wait two or three weeks for delivery of a certain model from our home factory. Basic machines and customized accessories are stocked in warehouse centers and distributor houses enabling us to meet your requirements exactly . . . and meet them quickly.

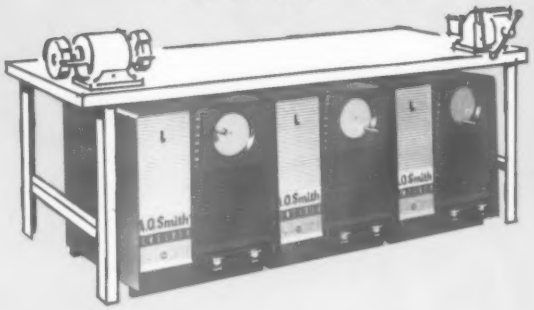


It stacks up to three high!



It racks!

It slides under a bench!



SEE HOW IT STACKS UP! The new MonArc line is on display at A. O. Smith welding equipment distributors everywhere.

SPECIFICATIONS

Series No.	Rated amperes at 40 volts	Input kw	Duty cycle	Primary amperes with PF correction		Primary amperes without PF correction		Power Factor*		Open-circuit volts	Welding range	Weight in pounds	Height	Width	Length
				230 volts	460 volts	230 volts	460 volts	without capacitor	with capacitor						
300 L	300	12	60%	100	50	108	54	65.4%	79%	80	60-430	363	28″	24″	30″
400 L	400	16	60%	124	62	140	70	65%	84.5%	80	75-550	400	28″	24″	30″
500 L	500	20	60%	158	79	174	87	66.7%	84.2%	80	90-670	415	28″	24″	30″

*Power factor is the average value which includes the benefits of the power factor capacitors when not welding (based on 60% duty cycle).

Because welding fabrication is our full-time business, A. O. Smith maintains the industry's most comprehensive research and development facilities. That's why we can offer you America's finest machines, accessories and electrodes. And when you call your man from A. O. Smith, you'll find that he's more than just a salesman. He's a welding specialist fully qualified to help with your welding problems.

Through research . . . a better way

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CORPORATION

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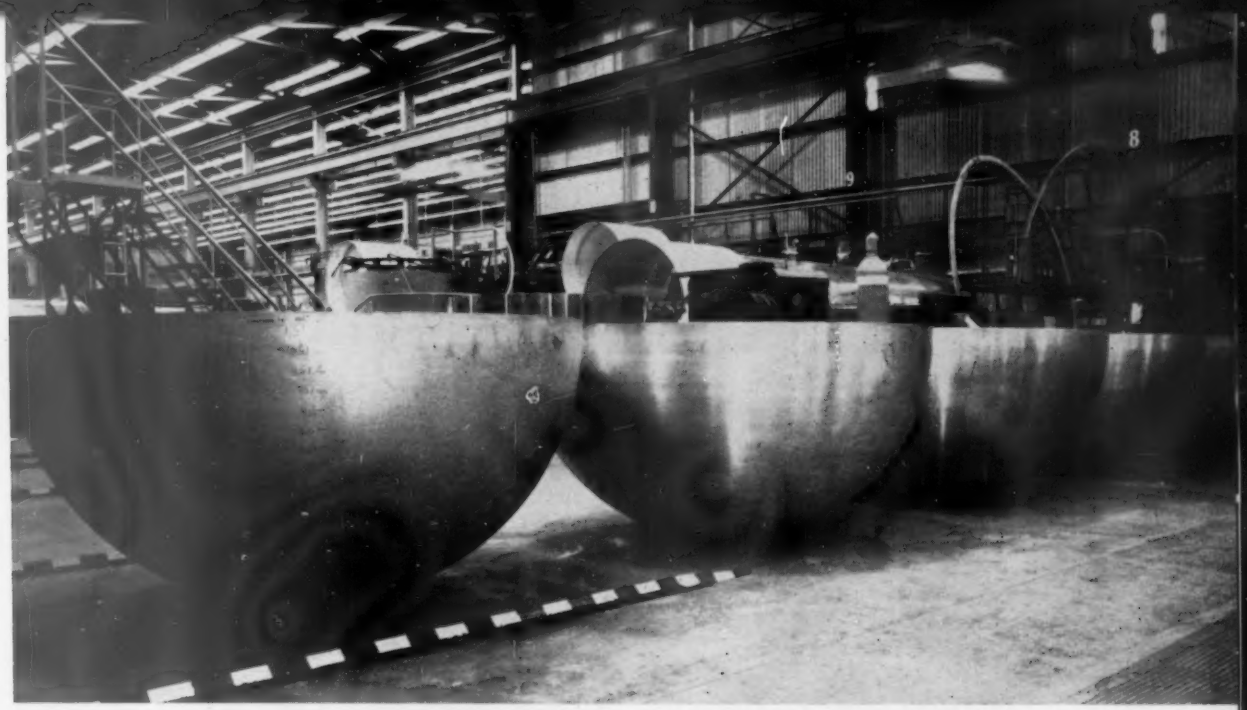
MW-263

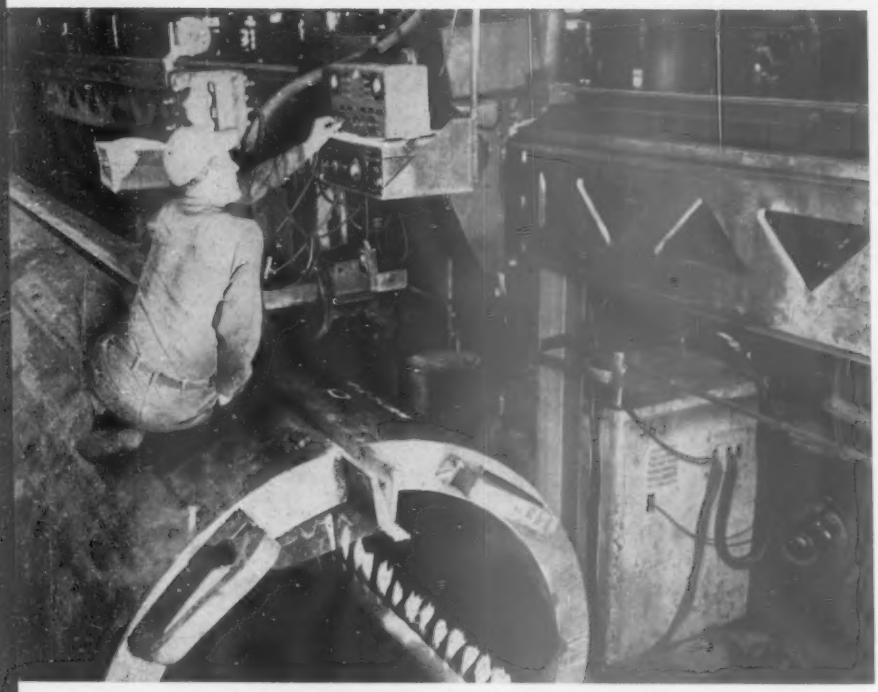
LITHO IN U.S.A.



ABOVE—"Spun" bulkheads shaped of aluminum supplied by Aluminum Co. of America, Pittsburgh, prior to being welded into cylindrical tank sections for the Saturn ballistic missile. At left—silicate slag floats out of weld on wrought iron pipe during water line construction near Manalapan, Fla. Pipe was produced by A. M. Byers Co., Pittsburgh.

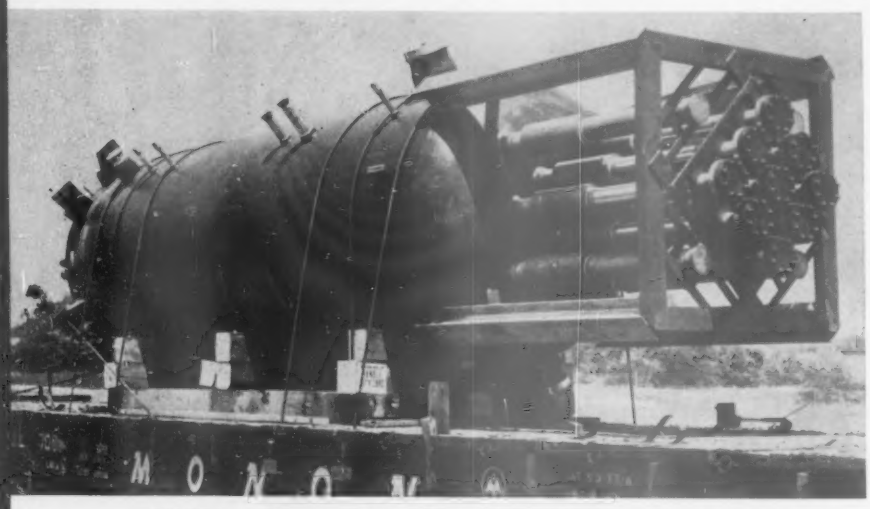
On the job...

AT right—main steel supporting members of this overpass crossing on Ohio's new North-South Thruway are four 141-ft welded plate girders placed on 8-ft centers. Jones & Laughlin Corp., Pittsburgh, were suppliers of steel plate.



AUTOMATIC longitudinal submerged-arc welder being used to weld a nuclear steam drum. Circumferential welding may also be accomplished on same machine.

Ultrasonic, gamma, X-ray inspect vital nuclear reactor components



REACTOR vessel is prepared for shipment to experimental boiling water reactor at Argonne National Laboratory.

WELDING, still in its comparative youth, is—naturally enough—playing a vital part in the development of another rapidly growing field, nuclear power.

In fabrication of the wide range of components required in the nuclear power industry, from steel cladding of interior surfaces to forming seams for steam drums, welding is considered the best method.

A concrete example of its role may be found in the operations of the Babcock & Wilcox Co., New York City, a manufacturer of boiler equipment for nearly 100 years. When controlled fission became a reality, B & W broadened its interest, like other firms, to encompass all aspects of nuclear reactor development and manufacture.

While the use of fissionable materials as fuel required the development of special techniques in design and construction of equipment, welding was still the joining process to be used, as in conventional systems in prior years.

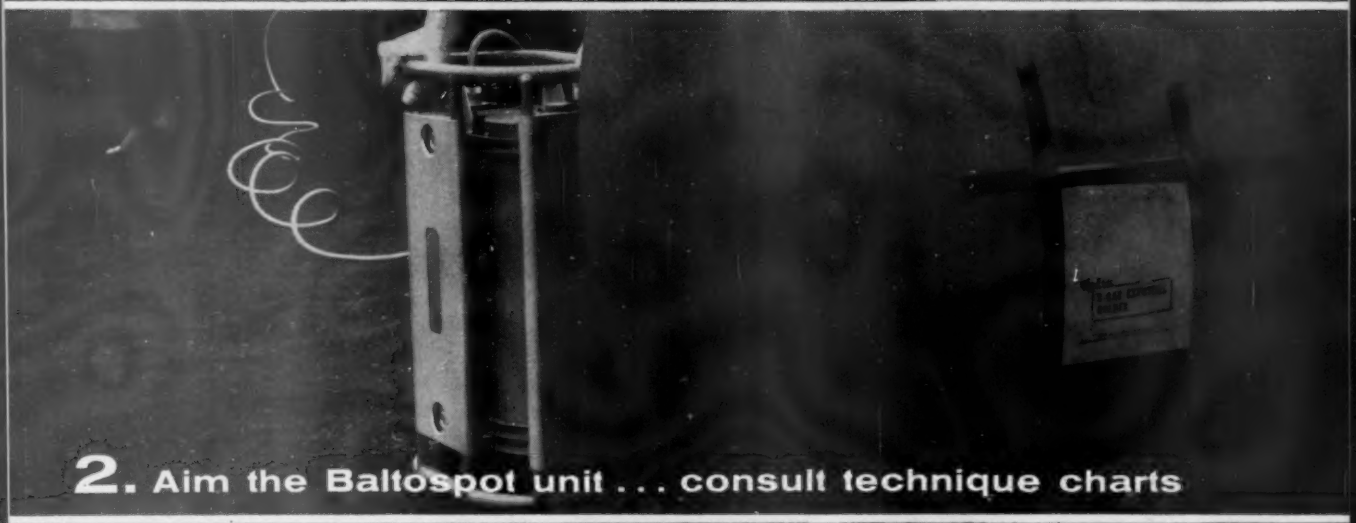
Today, a pressurized water reactor vessel—the nuclear power source—may be over 40 ft in length and have an inside diameter of 10 ft. It must withstand extremely high corrosion forces and its internal temperatures may range well over 1,050 F, at pressures from 1,500 to 2,500 psi.

Fabricated from top-grade carbon steel, a shell runs from 6 to 10 in. thick, and may weigh well over 280 tons. Even before steel plate is bent, it is examined thoroughly by ultrasonic processes. Heavy plate is then bent in half-cylindrical sections to form the outer walls of the vessels.

Plate edges are machine-grooved. Then an automatic submerged-arc welder moves along the joint, depositing metal to form a tight, integral structure.

For quality control, B & W tests these seams with a 2 million volt X-ray machine. The firm uses radioactive isotopes for inspection where

1. Attach the film holder



2. Aim the Baltospot unit . . . consult technique charts

3. Set the controls . . . press the button!

YOU'VE JUST MADE A WELD X-RAY!

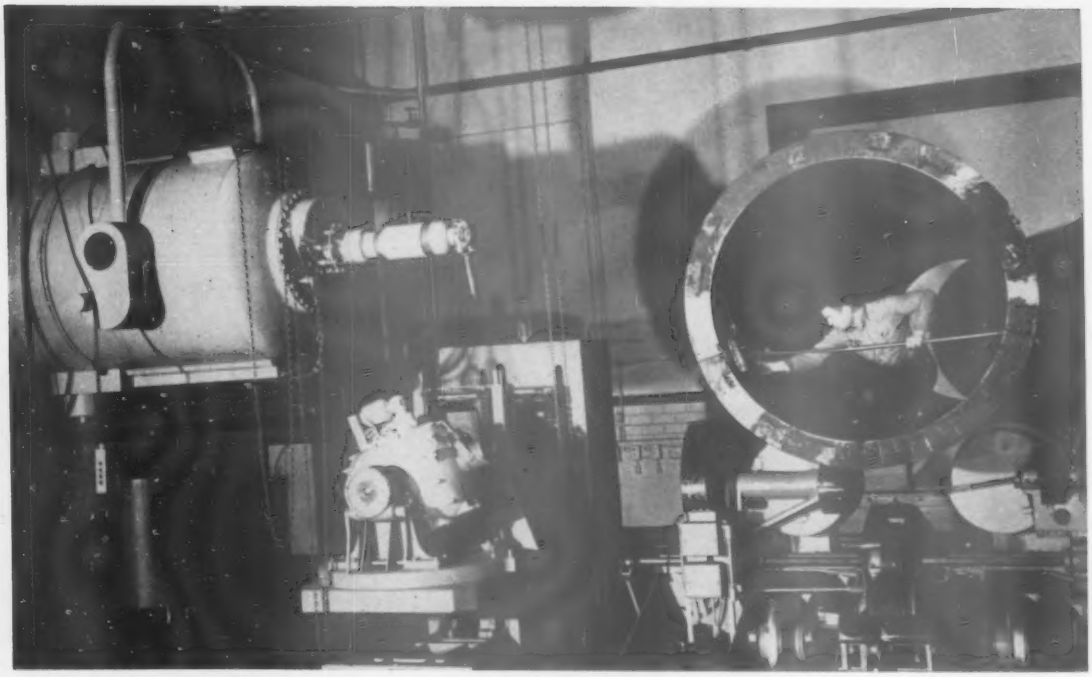
Taking repetitive or field X-rays is a 1-2-3 operation with this Baltospot portable unit—can be learned in less than a day. You simply carry the unit to the job, X-ray the weld, and develop the film—all in a matter of minutes.

And don't forget—X-ray weld inspection is a real cost-cutter, too (77% savings on inspection were recently reported by a prominent tank fabricator).

For the whole story, contact your nearby Westinghouse X-ray sales representative. Or write: Westinghouse Electric Corporation, X-ray Department, 2519 Wilkens Avenue, Baltimore, Maryland. J-08378

YOU CAN BE SURE...IF IT'S

Westinghouse



TWO million volt X-ray machine and cobalt-60 isoscope used by B & W to examine welds on nuclear components.

inaccessibility prevents the use of X-ray equipment. Here, two films are used in a single holder. The two pictures are evaluated jointly to distinguish between irrelevant film process markings and the actual shadow picture of the weld.

Ultrasonic testing is also used; pipe or tubing is placed in a rotating fixture coated with glycerin or oil, and revolved at a speed of 300 to 500 ipm. Any defect is quickly signaled on the reflectoscope.

Many of the firm's welding rods are fabricated and packed in its own shops to insure uniform quality. Another indication of quality control is the attention given stress relief. Four furnaces at the company's Barberton, Ohio, works were built by B & W, the largest of which will accomodate a charge up to 115-ft long and 14-ft wide.

In field stress relieving operations, if there is insufficient electric current available, B & W will ship large transformers to the site. Insulated or water-cooled copper cables are wound around the pipe or tube at the welding zone to achieve controlled heating. If conditions do not permit use of heavy equipment, the firm uses muffle heaters.

In cladding of the inner surface of reactor vessels to avoid corrosion, resistance welding bonds stainless steel alloy sheets to the base plates.

The strength of the bond, says the company, is such that attachments can be permanently welded to the steel without any necessity for cutting through the cladding to secure them to the base plates beneath. Some cladding is being done with the zirconium alloy (Zircaloy).

Of the company's other activities in nuclear power development, core testing occupies an important position. Fuel element arrangements are studied in the test core for the most effective distribution of power in the ultimate core assembly.

Flux distributions are measured with foils of metals that become radioactive under neutron bombardment. Critical experiments like this are, of course, carried on in shielded bays under low power levels, and with a number of safety controls in operation.

Stainless steel piping, necessary in the primary system of pressurized reactors, is produced on a massive draw bench at the Barberton plant. An 8,500-ton vertical press is used to pierce an opening into a heated ingot weighing as much as 26,000 lb. After fitting over a mandrel, the ingot is forced through a series of ring dies to produce a seamless, hollow forging.

For the primary heat exchanger flow circuit, which provides the necessary heat transfer link between the nuclear and non-nuclear sections of the steam-generating system, as many as 2,500 tubes in a variety of sizes and shapes may be needed.

Seamless tubing for this purpose may be hot-finished, cold-drawn, or roto-rocked, while welded tubing may be fabricated from hot or cold roller strip.

The extrusion process is used to manufacture seamless tubing of stainless steel and other metals that do not lend themselves readily to rotary piercing.

In a nuclear generator, these tubes must be joined to drums, tube sheets and headers with absolutely leak-tight joints. This is done by special welding and mechanical expansion techniques.

How Ni-Rod "55" builds up worn cast iron... keeps repair cost down

When the owners of the M V Sunprincess heard it would cost them over $7,200 to replace all six worn ship pistons, they quickly called in J & R Weir Ltd., Marine Engineers, Montreal.

These engineers in turn recommended a Ni-Rod "55"* repair job – welding to be done by Welding Engineers Ltd., Montreal.

Wear ran as high as ⅛ inch on some of the piston ring grooves. But with Ni-Rod "55" Electrodes, welders soon had all six pistons back in the ship at a total cost of $2,450 – a saving of over $4,750.

How they did the job with Ni-Rod "55"

Using Ni-Rod "55" Electrodes, they welded cast iron inserts into position on the pistons to offset the worn areas. The pistons were pre-heated to 500° F and each of the 6 inserts welded into position with two passes by manual arc-welding. After welding, the pistons were covered with asbestos to cool. Ni-Rod "55" eliminated the need for post-heating. Then the pistons were machined and returned to the engine.

For your jobs

Ni-Rod "55" can be used to build up worn areas in almost all cast iron parts. Auto, truck, or ship pistons... valve seats... cylinder walls... are just a few. And the cost is just a fraction of what replacement would cost. What's more, with Ni-Rod "55", the repair is done quickly and easily. Welds are strong, sound, highly machinable.

Keep Ni-Rod "55" in mind for building up worn areas on cast iron parts. Even better, have a supply of these electrodes on hand. Look in your classified directory under "Nickel" for your local supplier.

And *write* for "Repair Cast Iron Parts Quickly and Easily" for the complete Ni-Rod "55" story.

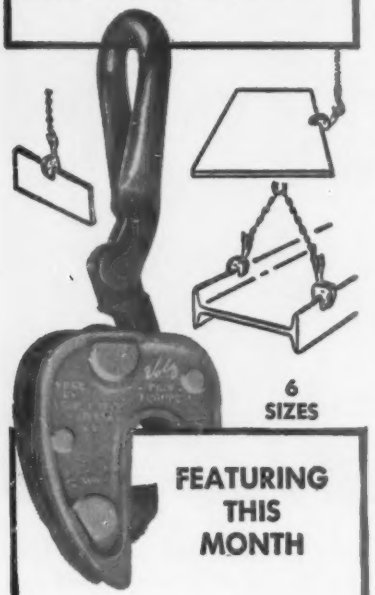
HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia

*Inco trademark

INCO TRADE MARK **WELDING PRODUCTS**
electrodes • wires • fluxes

YOUR BEST MOVE . . . MOVE
with **MERRILL**
MATERIAL HANDLING
DEVICES FOR THE MOST
IN *Safety and Economy*

Imitated, but never duplicated, Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.



6 SIZES

FEATURING THIS MONTH

LARGE OPENING "G" CLAMP
Designed for lifting and rolling extra heavy and extra thick plates and slabs. Standard 3" ranges to 12". All capacities.

Over 25 Material Handling Devices described in our catalog C-2.

Ask for a copy.

MERRILL BROTHERS
Producers of Drop & Press Forgings
56-81 Arnold Ave., Maspeth, N. Y.
1-60

Here's *WE*'s complete list of manufacturers

NON-DESTRUCTIVE TESTING EQUIPMENT and SERVICES

Dye Penetrant
Magnaflux Corp., Chicago, Ill.
Met-L-Chek Co., Los Angeles, Calif.
Picker X-ray Corp., White Plains, N.Y.
Turco Products, Inc., Los Angeles, Calif.

Film Badges and Services
Landauer, Jr., R. S. & Co., Matteson, Ill.
Nuclear Advisors, Inc., Long Island City, N. Y.
St. John X-Ray Laboratory, Califon, N. J.
Tracerlab, Inc., Waltham, Mass.
X-Ray Monitoring Corp., New York, N. Y.

Fluorescent Penetrant
Curtiss-Wright Corp., Princeton, N. J.
Magnaflux Corp., Chicago, Ill.
Philips Electronic Instruments, Mt. Vernon, N.Y
Picker X-Ray Corp., White Plains, N.Y.

Gamma Ray
Budd Co., Philadelphia, Pa.
Curtiss-Wright Corp., Princeton, N. J.
Metal & Thermit Corp., Rahway, N. J.
Picker X-Ray Corp., White Plains, N. Y.
St. John X-Ray Laboratory, Califon, N. J.
Tracerlab, Inc., Waltham, Mass.
Westinghouse Electric Corp., Baltimore, Md.

Magnetic Particle
Budd Co., Philadelphia, Pa.
Ferro Machine & Tool Corp., Indianapolis, Ind.
Magnaflux Corp., Chicago, Ill.
Peterson Machine Tool, Sperry Products, Inc., Merriam, Kan.
Picker X-Ray Corp., White Plains, N. Y.
Philips Electronic Instruments, Mt. Vernon, N.Y.
U. S. Casting Repair Corp., Philadelphia, Pa.
Westinghouse Electric Corp., Baltimore, Md.

Penetrameters
Jem Penetrameter Mfg. Corp., East Natick, Mass.
Radiation Equipment Co., Chicago, Ill.
Smith, Dr. K. A., Burbank, Calif.

Testing Laboratories & Services
General Magnaplate Corp., Belleville, N. J.
Magnaflux Corp., Chicago, Ill.
Pittsburgh Testing Laboratories, Pittsburgh, Pa.
X-Ray Products Corp., Rivera, Calif.

Ultrasonic
Acoustica Associates, Inc., Mineola, N. Y.
Aeroprojects, Inc., West Chester, Pa.
Branson Instruments, Inc., Stamford, Conn.
Curtiss-Wright Corp., Princeton, N. J.
Dice, J. W. Co., Englewood, N. J.
Electrocircuits, Inc., Pasadena, Calif.
Gulton Industries, Metuchen, N. J.
Narda Ultrasonics Corp., Mineola, N.Y.
National Ultrasonic Corp., Irvington, N. J.
Sperry Products, Inc., Danbury, Conn.

X-Ray and Fluoroscopy
Balteau Electric Corp., Stamford, Conn.
Bar-Ray Products, Inc., Brooklyn, N.Y.
Budd Co., Philadelphia, Pa.
Curtiss-Wright Corp., Princeton, N. J.
Du Pont de Nemours, E. I. & Co., Inc., Pattern Screen Div., Towanda, Pa.
Fedrex U. S., Roselle, Ill.
General Electric Co., X-Ray Div., Milwaukee, Wis.
High Voltage Engineering Corp., Burlington, Mass.
Kelley-Koett Mfg. Co., The, Covington, Ky.
Machlett Laboratories, Inc., Springdale, Conn.
Mitchell Radiation Products Corp., Norristown, Pa.
Philips Electronic Instruments, Mt. Vernon, N.Y.
Picker X-Ray Corp., White Plains, N.Y.
Ray Proof Corp., New York, N. Y.
St. John X-Ray Laboratory, Califon, N.J.
Standard X-Ray Co., Chicago, Ill.
Tracerlab, Inc., Waltham, Mass.
Travel-Ray Corp., Dallas, Texas
Triplett & Barton, Sperry Products, Inc., Burbank, Calif.
Westinghouse Electric Corp., Baltimore, Md.

X-Ray Film
Ansco Div., General Aniline & Film Corp., Binghamton, N. Y.
Du Pont de Nemours, E. I., & Co., Wilmington, Del.
Eastman Kodak Co., Rochester, N.Y.
Gevaert Co. of America, Inc., New York, N. Y.
Ilford, Inc., New York, N. Y.

X-Ray Film Salvage
Handy & Harman, New York, N.Y.

Boscobel weldor is attaching Jalloy #1 steel wear plates to Bucyrus Erie alloy body and manganese steel lip with Wear-O-Matic WH wire.

35% *Savings on bucket maintenance with NEW Wear-O-Matic WH welding wires*

"Wear-O-Matic WH is the most versatile welding wire for bucket maintenance because it provides high strength welds in any of the popular alloy steels and has excellent resistance to impact when used for build-up work. Savings in time and labor through the semi-automatic open arc application of this wire have resulted in less bucket down time and lower costs."

L. ARDEN HENLEY, SUPT.
BOSCOBEL GRANITE CORP., MANAKIN, VA.

WHAT about bucket maintenance in your shops? Costs too high due to too many manual welding applications? The important benefit gained by Boscobel Granite was the elimination of manual welding with stainless steel electrodes to obtain the necessary high strength attachment welds for their rugged rock handling chores. These benefits can be yours whether you are welding manganese to manganese, manganese to carbon steel or either of these to any of the abrasion or impact resistance alloy steels. Then, without changing wires, your weldor can apply build-up deposits to lesser worn areas such as latch pins, keepers and lips . . . a deposit that will work harden to outwear manganese steel. To put more service life in the business end of your shovels and drag lines, investigate today the semi-automatic open arc application of Wear-O-Matic WH wires. You'll lower your maintenance costs . . . decrease down time and increase working life. For complete details, request Bulletin AR-21. Alloy Rods Company, P. O. Box 1828, York 2, Pa.

ALLOY RODS COMPANY

YORK, PENNSYLVANIA

SALES OFFICES AND WAREHOUSES • NEWARK, PITTSBURGH, PHILADELPHIA, BOSTON, CHICAGO, SAN FRANCISCO, EL SEGUNDO, CALIFORNIA — DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

Ultrasonic Flaw Detection now Ultra-Practical in every shop!

THE NEW BRANSON

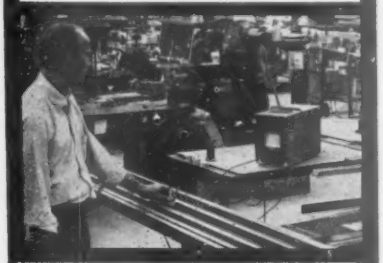
SONORAY®

MODEL 5

pulse-echo type instrument

combines the highest performance yet achieved with the smallest size, weight and price in the field. It is equally at home in contact and immersed work.

Every metalworking shop can now afford quick, accurate, inexpensive tests on internal structure of Bar Stock, Strip, Plate, Castings, Weldments. Brazed Assemblies, Machinery Shafts, etc.



SONORAY® Ultrasonic Flaw Detector testing aluminum bar stock; easily probes the full 12-foot length as well as through thickness.

SONORAY® Model 5 clearly resolves 3/64" FBH at 3/16" in contact at 2.25 mc/s — reveals 1/64" FBH full-scale at 2.25 and 5.0 mc/s — brings laboratory precision into the field with simplified controls, a weight of only 37 pounds and a price of . . . . . **$2750.**

Use coupon for Bulletin T-200

BRANSON INSTRUMENTS, Inc.
59 Brown House Road • Stamford, Conn.

BRANSON INSTRUMENTS, INC.
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Send SONORAY® Bulletin T-200 to

NAME_____

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ADDRESS_____

Tig cutting boosts stainless steel sales

IT TAKES MORE to sell a product than just the product itself.

Morrison Steel Co., New Brunswick, N. J., is a firm that adheres to this belief. In the case of this eastern steel and aluminum service center, the product is stainless steel, and what it takes to sell that product is an efficient, economical way of cutting the metal.

Morrison's answer to the problem is tungsten arc cutting, utilizing equipment of Linde Co., New York City. Straight line cutting of stainless steel is largely accomplished by shearing, abrasive sawing and powder cutting. When it comes to irregular shapes, however, the field has been limited to two principal methods, both with disadvantages.

Band sawing stainless plate is no better than the skill of the operator, who must manipulate the plate much as if it were on a jig saw. The widely used and accepted method of powder cutting, while satisfactory for most purposes, also has its limitations — usually requiring machining and annealing of the cut edges.

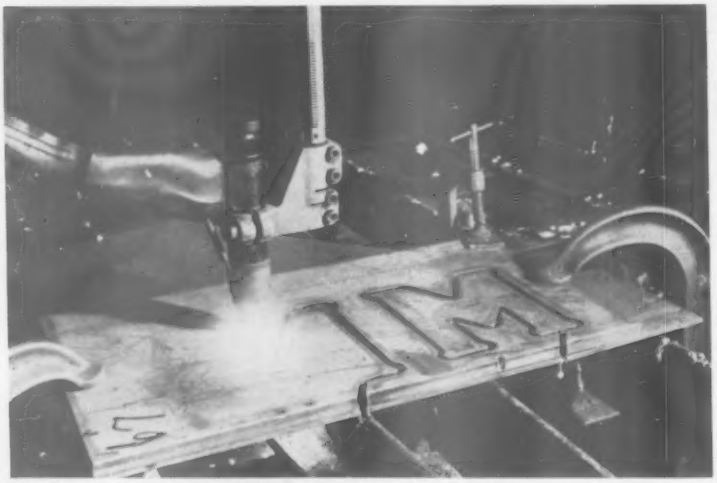
The Tig cutting process eliminates these problems and offers: (1) minimum carbide precipitation; (2) unchanged machinability and magnetic permeability; (3) exceptionally close tolerances; and (4) no distortion or discoloration.

Because of these advantages, many stainless parts can be used directly after arc cutting without the necessity of additional pre-use preparation. Potential savings to the user are great. Because a close-tolerance, uncontaminated cut is assured, there is seldom any need to remove the cut edge.

Morrison's cutting equipment consists of a Tig cutting torch, combined with a conventional panograph cutting machine using an electronic templet tracer. Gas used is a 65%-argon-35% hydrogen mixture. The combination of the heat and force of the arc stream produces saw-like cuts at an average speed of about 15 in. per minute.

Among parts the firm has cut from stainless plate are gear blanks, flanges, baffle plates, discs, and decorative pieces.

Introduction of Tig cutting at Morrison has made it possible to utilize stainless drop-ends from other cutting operations; to increase the inventory of plate sizes that could not be handled with previous cutting equipment; and to expand market potential, since it is now possible to supply shapes which would otherwise be unavailable.



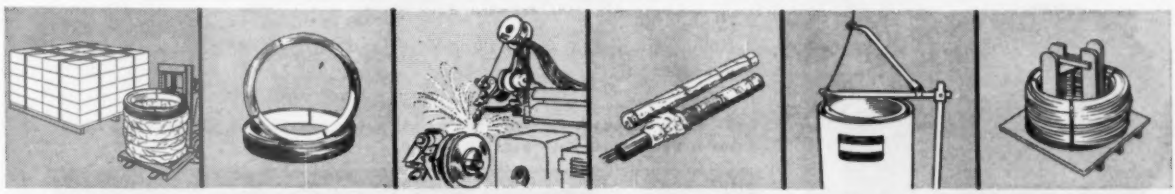
TIG shape cutting of 1-in.-thick stainless steel plate helped increase sales of eastern service center.

PAGE offers
THE WIDEST CHOICE OF WELDING WIRES

FROM 33 ANALYSES of automatic welding wires, PAGE can supply the *right* wire for *any* welding operation. For instance, for welding high-carbon and sulfur-bearing steels, PAGE Analysis A-S-18 is the answer. It's the first successful wire developed for this purpose. Or for jobs where exceptional ductility is required in the welding of mild steel, Analysis A-S-6 would be the choice. When particularly tough welding problems exist, we can develop *special* wires to solve them.

PAGE also supplies a complete range of metal spray wire, bare and sulcoated electrodes, and gas welding rods. Regardless of *your* welding requirements, PAGE can furnish the *right* wire—with the size, temper, finish and uniformity you need.

PACKAGING TO MEET YOUR NEEDS



25-lb. or 60-lb. coils, single or palletized—also in single or palletized individual cartons, or in waterproof reusable fiber-board drums.

120-lb. or 180-lb. coils, paper-and-burlap wrapped, or in palletized cartons. Special coil sizes on application.

25-lb. reels (spools) in cartons are designed to fit all standard machines; single or palletized to meet your requirements.

Gas welding rods in 50-lb. paper-and-burlap bundles; in fiber-board cartons of 10 lb.; and in boxes of 50 lb. or over.

Payoffpaks and Leverpaks are furnished with diameters ranging from 15" to 23" and capacities from 250 lb. to 700 lb.

Payoffpallets hold 900-1200 lb. of wire (sizes 3/16" to 3/8" incl.) coiled around pedestal on top of a wooden pallet.

QUICK DELIVERY FROM LOCAL STOCK

PAGE welding wires, rods and electrodes are as near as your phone. Prompt delivery is assured from a coast-to-coast network of PAGE distributors, backed by a nationwide system of strategically located warehouses. At all times, PAGE welding specialists are ready to give expert advice.

Call on us for help.

These Folders can help you... *Write us at Monessen, Pa., for name of nearest* PAGE *distributor and for:* **Folder DH-402-0** • Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. **Folder DH-1218** • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes, gas welding rods. Shows uses and properties. Lists most competitive makes.

PAGE WELDING WIRE

ACCO

Page Steel and Wire Division
American Chain & Cable Company, Inc.

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.

**Indicates PAGE warehouse stocks*

PAGE —the source for answers to welding problems

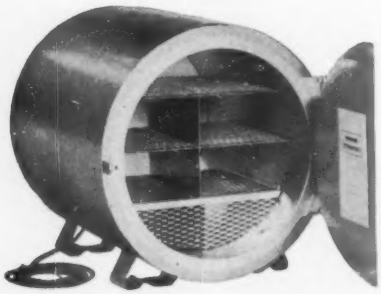
YOU CAN KEEP 'EM DRY

FOR 14c A DAY

Moisture-proof your electrodes at low cost with

DryRod®

OVEN



Fourteen cents worth of electricity per day — that's about all it takes to operate the popular, Type 300 DryRod electrode oven. At that rate, and its low purchase price, you can't afford to be without DryRod protection against moist mineral coated rods. Insure your electrode investment against:

- POROSITY • UNDER-BEAD CRACKING
- ROUGH WELDS • ROD SCRAP LOSS
- REJECTS • REWORKS
- PRODUCTION SLOWDOWN

NEW! 800° or 1000° HIGH TEMPERATURE Re-baking Oven now available

The DryRod line of ovens now includes four basic models to meet every welding requirement.

Write for new folder "DryRod as Standard Welding Equipment".

PHOENIX PRODUCTS COMPANY

4727 N. 27th St. • Milwaukee 9, Wis.

Tig welding fabricates an aluminum duct

TIG WELDING eased the installation of aluminum ventilating duct in the largest office building west of Chicago.

Approximately 300,000 lb of aluminum duct sheet were welded for the 28-story center of Kaiser Aluminum & Chemical Corp., Oakland, Calif. Ranging in thickness from 0.025 to 0.050 in. the sheet was fabricated into duct by the Scott Co., Oakland.

For joining longitudinal and perimeter sections, the company devised special jigs—boom-like units with two arms. The top arm was the track for the welder and the bottom arm was the holding fixture—a steel pipe with a copper strip on top.

Rolled aluminum sheet, flanged and open at the seam, was placed around the fixture, with the seam resting on the copper. As the Tig welder moved down the track to fuse the seam, water was pumped through the pipe to cool the copper bar.

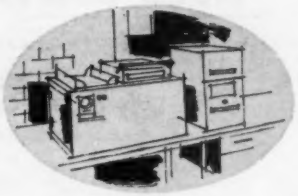
The setup for perimeter welding was similar, except that the holding fixture had angle iron arms that extended by compressed air until they met the duct sides. Three 4-ft sections of round duct were fused to form a 12-ft section.

A special punch press rig was able to knock out 4-in. circles and simultaneously drill three holes in ducting where flexible tubing tied into branches. All other work—shearing, rolling, crimping, etc., was performed in the usual manner and with the use of standard equipment.

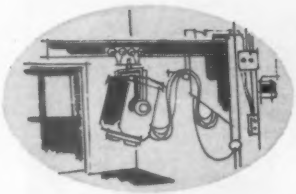
PART of the all-aluminum ventilating system going into 28-story center is this 63-in.-diameter duct. Seams have been Tig-welded.

Nine different ways...

TVX
remote-inspection unit

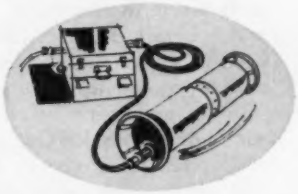


Xeroradiographic unit for
dry-process radiography



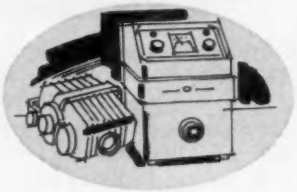
OX-250 general
utility x-ray unit

Resotron 300*—
300-kvp portable x-ray

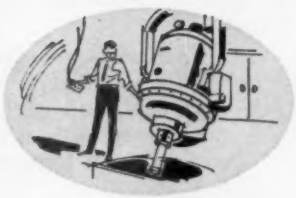


OX-175 — 175-kvp
portable x-ray

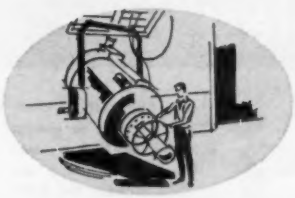
LX-140 — ultra-compact
portable x-ray



LC-90 lightweight
mobile x-ray



Resotron 1000*—
million-volt x-ray



Resotron 2000*—
2-million volt x-ray

to look at your products!

Let General Electric X-Ray lend a hand

G-E x-ray inspection equipment covers every need — with units available in power ranges from 5 to 2,000-kvp output . . . choice of wet or dry radiographic processing . . . even *remote-television* x-ray fluoroscopy. Production-line, continuous inspection can easily be arranged where desired.

There's no need at all to settle for piecemeal help when you want x-ray apparatus, supplies or installation-planning assistance. Instead, take advantage of the industrial x-ray experience General Electric has gained through half a century of serving needs and solving problems much like your own. You stand to come out ahead in many ways. Our specialists have the knowledge that can find right answers in a hurry. Our research facilities are set up to solve even the most unusual puzzles.

For assistance with your inspection problems, contact our office in your area, or just write X-Ray Department, General Electric Company, Milwaukee 1, Wisconsin, Room AE-64

* REGD. T.M.

Progress Is Our Most Important Product

GENERAL ELECTRIC

News Shorts . . .

Demand for nickel, which rose sharply last year, is expected to continue high this year, Dr. John F. Thompson, board chairman of **International Nickel Co. of Canada, Ltd.**, New York City, told stockholders at the firm's recent annual meeting . . . The U. S. will provide Japan with nuclear fuel for three new research reactors under terms of lease agreements signed in April. The materials are being transferred to Japan under the provisions of a research and power agreement that went into effect in 1958 as part of the Atoms-for-Peace program.

An unusual service is provided by **General Magnaplate Corp.**, Belleville, N. J. The company maintains a Beechcraft Bonanza (see photo) at Teterboro Airport, N. J., for the purpose of providing a full line of non-destructive testing equipment, products, and components anywhere in the U. S. . . . Officials of **Air Reduction Sales Co.**, New York City, and the city of Tampa, Fla., recently broke ground for Florida's first commercial liquid air separation plant. Oxygen, nitrogen and argon will be produced at the rate of more than 30 tons daily in the multi-million dollar plant. Completion is expected by early fall.

To meet increased industry needs, **Arcwire Corp.**, Philadelphia, is enlarging its Mt. Carmel, Pa., plant. The addition is a prefabricated structure with a framework of welded steel columns and trusses which will span the 60-ft width of the building without inside columns . . . The new manufacturing plant nearing completion in Houston will give **Ransome Co.**, Scotch Plains, N. J. 50% more floor space than it has at its present facilities at Plainfield, N. J. Although only

"DURO is the coolest"*

*says Ben Ruff of Reed & Graham, Inc. "Before I had to change holders whenever the one I was using would get hot. Now, with DURO, I can weld a whole shift without the holder getting hot to my hand, even when using 5/16 in. hardfacing electrodes at high amperages."

DURO will do the same for YOU

Proved by 28 years of welder's preference

- The Duro Electrode Holder has served the welding industry since 1932. It is famous for long life, positive grip and perfect balance. All parts are easily renewed. Semi- or fully insulated. Duro is available in 250, 300, 400, 500 and 600 amperes capacity.
- Cool operation — cool handling. Featuring "Long Jaw Design" for reaching those "hard to get at places."

THE DURO "STANDARD"

- Another feature is the square guard. It protects hands from heat and also prevents rolling and grounding when placed on a flat surface. There when you need it, is a hex key fitted into the brass core and held in place by the fiber handle for making fast cable connections.

DURO ENGINEERING COMPANY
31 OREGON AVE. · HAMDEN, CONN.

TO BE SURE . . . YOU ARE GETTING A LONGER-LASTING STEEL

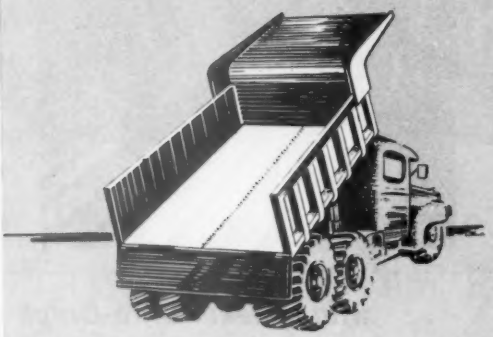
SPECIFY — **MANGANAL**®

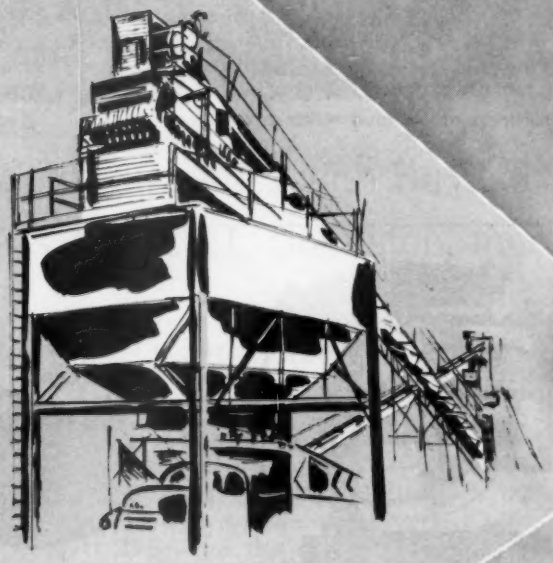
11¾-13½% MANGANESE-NICKEL STEEL

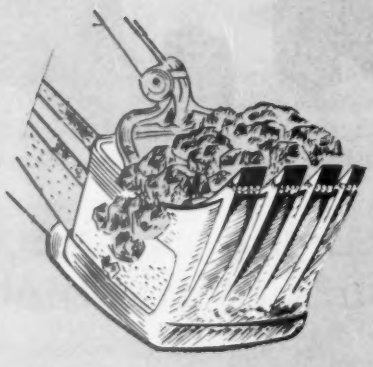
HOT ROLLED PLATES

TO REPAIR and REBUILD

QUARRY & MINE SKIPS • GRAVEL & CRUSHED STONE CHUTES
• SHOVEL & DRAGLINE BUCKETS • TRACTOR EQUIPMENT
• SHOT BLAST CABINETS • FOUNDRY SHAKEOUT MACHINES
• PEDESTAL & JOURNAL BOX LINERS • STEEL MILL EQUIPMENT
• QUARRY-TRUCK LINERS • MUCKERS • CRUSHER LINERS
• CRUSHER HAMMERS • CONVEYOR FLIGHTS, ETC.







- Workhardens to a high degree under impact and heavy abrasion.
- Polishes to a smooth finish, minimizing friction-wear.
- Highest tensile strength . . . tough, too!
- Costs less than new parts; cuts down time; reduces maintenance costs.

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

LEARN HOW YOU, TOO, CAN REDUCE DOWNTIME — WRITE FOR LITERATURE NEAREST DISTRIBUTOR UPON REQUEST

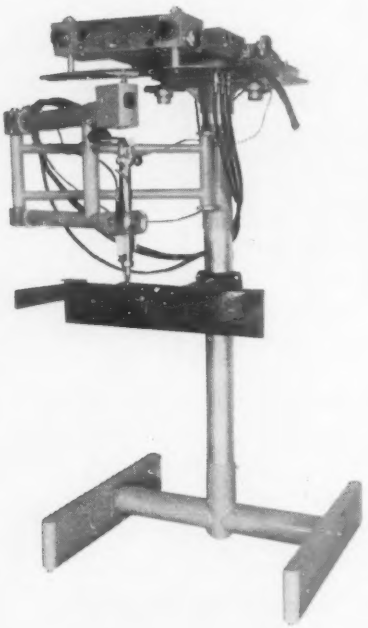
STULZ-SICKLES CO.

• Elizabeth, New Jersey

one story high, the facility is taller than the average 4-story building, so that it can accommodate even the tallest of the firm's manipulators and positioners.

Direct educational and warehouse service for maintenance weldors in a four-state area surrounding the Twin Cities of Minneapolis-St. Paul has been established by **Eutectic Welding Alloys Corp.**, Flushing, N. Y. The center, at 1046 First Ave., S., Minneapolis, offers free courses in maintenance and repair welding and on-the-spot demonstrations . . . Presently scheduled expansion of facilities at **Linde Co.**, New York City, will increase the oxygen production capacity of the firm by 4,000 tons. Current expansion amounts to more than 20% of the total presently installed U. S. production capacity.

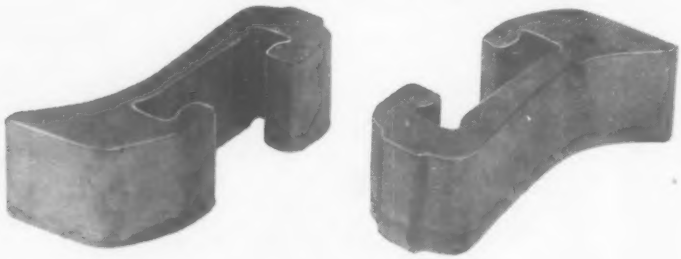
A new sales office and warehouse has been established in Detroit by **Shieldalloy Corp.** Located at 14360 Livernois Ave., the office will serve specialty steel producers, foundries and other users of metallurgical materials in Michigan, Illinois, and Indiana . . . **National Cylinder Gas Div., Chemetron Corp.**, Chicago, performed the welding on the first shipment of welded rail to be exported from the U. S. At Pueblo, Colo., 39-ft lengths produced by **Colorado Fuel & Iron Corp.** were welded into 78-ft lengths by NCG for shipment (see photo) to Mexico . . . A new office has been opened by **Philips Electronics Instruments**, Mount Vernon, N. Y., at Burlingame, (San Francisco) Calif. Personnel there will assist on sales and service problems of Norelco western dealers.



SERIES 460 ULTRA-GRAPH

Send for information on Ultra-Graph Guidance Machines for application to flame cutting or welding. See your Local Welding Supply Dealer for a demonstration.

with a Heath Ultra-Graph



Rough cutting of blanks saves hours of machining

Production time for a single part can be reduced 25-50% by initially flame cutting the desired shape with an Ultra-Graph Guidance Machine. Dimensions are held to close tolerances and exceptionally clean smooth finishes are obtained. Only a few minutes are required to cut any part suitable for weldment, assembly, or additional high finish machining. A U-G machine affords distinct economic advantages for prototype and short run or quantity production.

HEATH ENGINEERING CO.

168 AULT ROAD
FORT COLLINS, COLORADO

300 Per Cent Increase in Welds X-rayed...with Du Pont Day Pack Roll Film, Reports Herrick L. Johnston, Inc.

"This great new Du Pont Roll Film has enabled us to *triple* circumferential welds x-rayed in a single 8-hour period," says James C. Lutz, Supervisor, Quality Control Department.

Designers and manufacturers of ground-handling equipment for major rocket and missile programs (including the Atlas, Titan and Jupiter), this Columbus, Ohio, firm of cryogenic specialists must adhere to strict specifications in the construction of pressure vessels of all sizes. Naturally, x-ray techniques afford the best means of guaranteeing weld strength and providing permanent records required by law.

A. W. Schultz (left), Du Pont Technical Representative, discusses advantages of Roll Film with Mr. Lutz (center), and Mr. Wright, Director of Manufacturing.

"It used to take two men all night to shoot and process two seams with cut film," states Mr. Lutz. "Now, using Du Pont Day Pack Roll Film, the same team completes an entire vessel of *six* seams per night. Believe me, that's a real advantage!"

Comments Gwynne A. Wright, Director of Manufacturing, "In addition to vastly improved operational efficiency, we save time and money other ways as well. For instance, we now process 22 feet of roll film in the same 5-gallon developing tank we used to need for 9 feet of cut film. Total processing time: 84 minutes for an entire vessel. Small wonder we place so much value on the Du Pont Day Pack!"

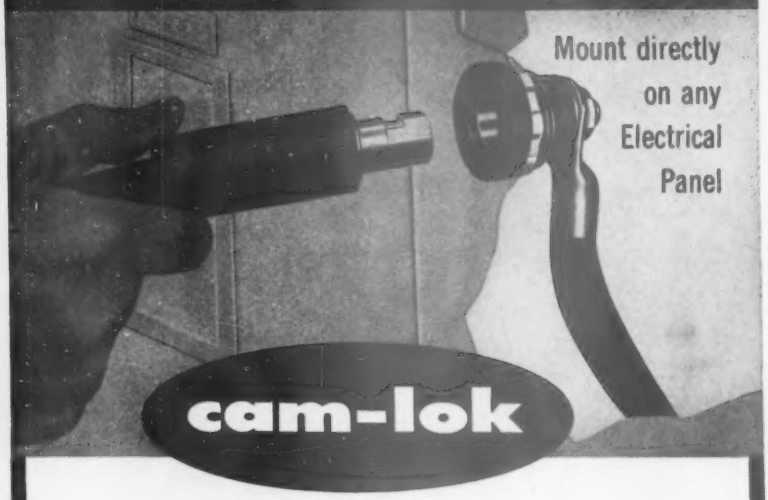
For more information on Du Pont Day Pack Roll Film, and other fine industrial x-ray products, write E. I. du Pont de Nemours and Co. (Inc.), Photo Products Department, Wilmington 98, Delaware. In Canada: Du Pont of Canada Ltd., Toronto.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

New Hi-Impact Plastic Insulated

Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

"Dead Front" design for fast
direct mounting on . . .

- ELECTRICAL DISTRIBUTION PANELS
- SWITCHGEAR
- BUS DUCT
- JUNCTION BOXES
- WIREWAY or any electrical cubicle

cam-lok
DIVISION

EMPIRE PRODUCTS, INC.
P. O. Box N-98
Cincinnati 36, Ohio

News . . .

Nondestructive test course to be held at Ohio State

In response to requests from industries, government agencies, and materials testing laboratories, the Summer Conference Course on Fundamental Principles of Nondestructive Testing will again be presented by the Department of Welding Engineering of Ohio State University.

The intensive two-week program, which will run from September 12-23, is designed to train personnel in basic principles and proper applications of nondestructive tests.

Lecture and laboratory coverage of test methods will include: x-rays, radioisotopes, ultrasonics, eddy currents, liquid penetrants, magnetic particles, electrified particles, filtered particles, and strain-sensitive coatings.

Resistance equipment deliveries up 17%

Shipments of resistance welding equipment exceeded $3 million during March, a gain of 17% over February, according to statistics compiled by the Resistance Welding Manufacturers' Assn.

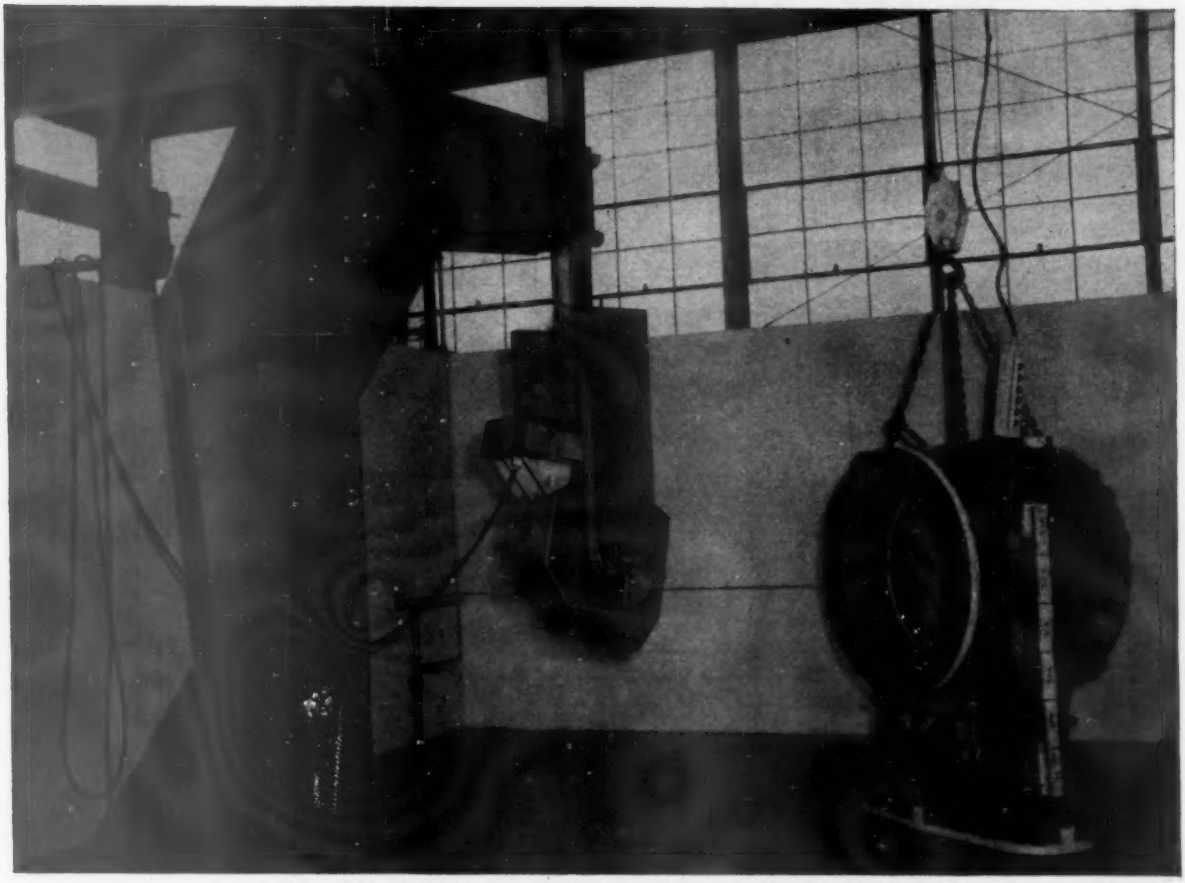
Shipments during the first quarter increased 30% over the corresponding period in 1959, the organization reported.

Hobart summer course opens June 13

Selection of electrode sizes, current adjusting, sheet metal and fillet welds, stainless steel and cast iron welding, and flame-cutting will be among the topics covered at the Hobart Welding School Summer refresher course. It is scheduled for the weeks of June 13, June 27, July 11, July 25, Aug. 8, and Aug. 22.

NCG accounting office moved to Pennsylvania

Northeastern regional accounting office of National Cylinder Gas Div., Chemetron Corp., Chicago, has been moved from Cleveland to Bala Cynwyd, Pa. The move situates all northeastern regional activities of the company in that location.



A Model 1061 Multitron radiographing a large steel valve casting at Pacific Southern Foundries, Inc., Bakersfield, California, a subsidiary of Pacific Valves, Inc., Long Beach, California. Model 1061, a 1000 curie-cobalt 60 source, features fully automatic fail-safe protection and remote operation from a console control center. The special mounting stand was designed and fabricated by Pacific Southern Foundries, Inc. and Pacific Valves, Inc.

SAFE!... Budd Multitron® and Iriditron® Units for Gamma Radiography

- **Hermetically sealed sources are under positive control at all times**
- **Shielding for sources is latest design**
- **Source position indicator shows exact location of source**
- **Fail-safe mechanism returns source to shielded head if power fails — on all units having electric drive**

Maximum safety with minimum weight: that's the story of Budd radiography equipment. You can select the equipment that best fits your requirements from the 21 standard Multitron and Iriditron models now available. One of the Budd models will give you the method or methods of exposure, number of sources, source materials, strength and types of mountings you need . . . all with maximum safety.

Budd offers complete service—radioactive source supply and encapsulation, source replacement and disposal, training for your personnel (at no charge) and assistance in setting up complete radiographic facilities.

Contact Budd Instruments Division for new Gamma Radiography bulletin . . . or for a consultation on your requirements.

INSTRUMENTS Budd DIVISION

THE BUDD COMPANY • P.O. Box 245 • Phoenixville, Pa.

Consult your phone book for sales offices in: Atlanta, Ga., Oak Park, Ill., Dallas, Tex., Los Angeles, Calif., San Francisco, Calif.

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AUCTION IT!

...and invite HANDY & HARMAN to bid

We don't care where it is, how much you've got or what shape it's in, we'll bid on it. Because our bids are based on *complete* recovery of the film's silver value by *burning*, our price is never controlled by seasonal demands. You stand to make more, *all of the time* from the bidder who wants only the silver.

In dealing with the nation's biggest refiner of precious metals, you are assured of prompt payment (usually within a week).

Call or send coupon to the Handy & Harman Refining Station nearest to you for a prompt and profitable bid on X-ray film of any kind in any amount.

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COMPANY_____

ADDRESS_____

Reprints from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc., Box 28, Morton Grove, Ill.

Techniques for torch brazing aluminum

Procedures and techniques for brazing aluminum, are detailed. Includes data sheet on brazability of aluminum alloys plus four tables listing commercial products and their characteristics. This reprint is free.

Design for welding

Basic knowledge required when designing, or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability

Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page reprint includes three data sheets.

Tungsten inert gas

A 16 page report on the history, theory and application of the Tig welding process. Includes data sheet on proper current selection. This reprint is free.

Welding of dissimilar metals

Complete details on welding dissimilar metals using NiCrFe electrodes and wires. Eight page reprint includes charts on properties, test results and data sheet on properties of other metals.

Acetylene

A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Fixtures for brazing

Presents requirements for designing brazing fixtures and materials to be used. Data sheet on properties of non-metallic fixture materials included. This reprint is free.

Selection, welding of CrMo alloy steel pipe

Discusses determining factors in selection of chromium-molybdenum alloy steels and evaluates the effects of pre- and postheat treatment on weld properties.

How to select proper regulators

Performance characteristics of equipment controlling gas flows during welding, cutting and other operations are given, as well as selection rules.

Filler metals for joining

Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Production welding controls

Discusses how material, labor and overhead effect total production welding costs, and how certain controls can result in greater time and dollar savings. This reprint is free.

New aluminum alloy not prone to brittle fracture

Extensive testing of 5083 aluminum alloy proves it has excellent weldability and weld ductility, and a good resistance to corrosion and stress corrosion. Testing for brittleness is detailed.

Explosive welding and forming open another door

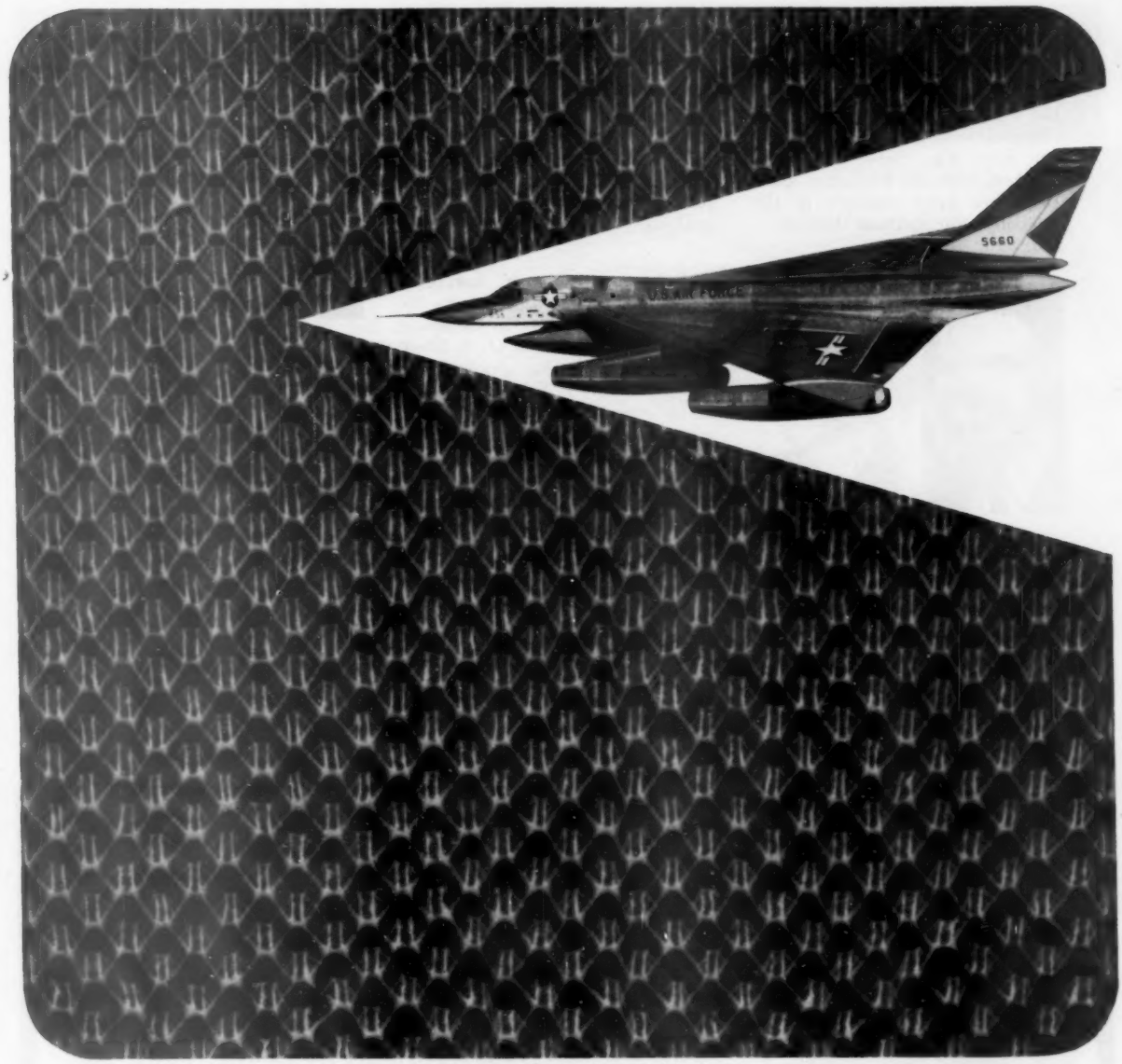
A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

Our modern-day mythology

A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Understanding weld distortion and shrinkage

Causes of distortion and shrinkage can be determined if weld heat is understood. Eleven drawings are used to illustrate this welding problem.



Gevaert X-ray films are used to inspect wing structure of Convair B-58 "Hustler."

GEVAERT STRUCTURIX X-RAY FILMS

.... *for proof of the product*

Quality-conscious industries rely on Gevaert X-ray films to assure product perfection. These films probe deep to search out hidden flaws, and their emulsion and base characteristics combine to define and separate the most delicate tones.

Gevaert Structurix X-Ray Film Types—

D-2: A unique slow-speed film of incomparable quality. D-2 gives by far the highest detail and finest grain available in any film. It is designed especially for rechecks and production inspection of thin or medium metal sections, and light metals.

D-4: A medium-speed fine grain film for inspecting medium thick or thick sections of light metals, and thin sections of heavy metals.

D-7: A high-speed film for inspection of medium to fairly thick light metals, thin and medium sections of heavy metals. Also for gamma radiography.

If you would like the details on all five Structurix Films, send for the free new booklet "Gevaert Industrial X-Ray Films."

GEVAERT

THE GEVAERT COMPANY OF AMERICA, INC.
321 West 54th Street, New York 19, N. Y.
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About people . . .

J. M. Crockett has been appointed vice president—gases by Air Reduction Sales Co., New York City. Crockett, with Air Reduction since 1945, has been manager of the company's Birmingham district office.

Crockett

Baltzegar

Cecil Baltzegar has been named manager of the newly-created market research department at Omark Industries, Inc., He has been with Omark since 1953.

Recently appointed an officer of the Order of Merit for Research and Invention by the Society of Encouragement of Research and Invention is *Dr. Felix Zandman* of Budd Co., Philadelphia. The French-sponsored award was made for his research in the field of stress analysis.

J. Robert Ferugson, Jr., has been named assistant vice president—design and construction in the engineering department of U. S. Steel Corp., Chicago. Also appointed to new posts were *P. S. Weaver* to assistant vice president in charge of appropriations, and *Samuel Naismith* to assistant vice president, facility planning. Both men have been with U. S. Steel since the 1930's.

Named product manager—distributive products for **A. O. Smith** International S. A., is *James M. Leinenkugel*. His new duties will include the development of sales potential in all marketing areas outside of the U. S. on welding products. Leinenkugel has spent the last four years in Maracaibo, Venezuela.

Emery

Bennett

William J. Emery has been appointed administrative assistant at Uni-Flex Manufacturing & Engineering, Inc., Los Angeles. He will assist in long-range planning and coordination of sales and engineering on expansion joints, cryogenic vessels, vacuum-jacketed piping and plastic products.

Behr-Manning Co., Troy, N. Y., has appointed *William J. Bennett* national field sales manager of its coated abrasives division. He has been manager of coated abrasives sales in the eastern region for the past five years.

. . . but when it comes to
Non-Destructive Testing, it's
GENERAL MAGNAPLATE to the rescue!

GENERAL MAGNAPLATE NOT ONLY TESTS PRODUCTS, MATERIALS AND COMPONENTS IN ITS PLANT, BUT IT IS NOW AT YOUR SERVICE IN YOUR PLANT IN A MATTER OF HOURS . . . VIA ITS . . .

- ULTRASONIC THICKNESS MEASUREMENT
- ULTRASONIC FLAW DETECTION
- X-RAY GAMMA RAY
- MAGNETIC PENETRANT
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CORPORATION
PLANTS IN BELLEVILLE, NEW JERSEY
AND CORONA, LONG ISLAND

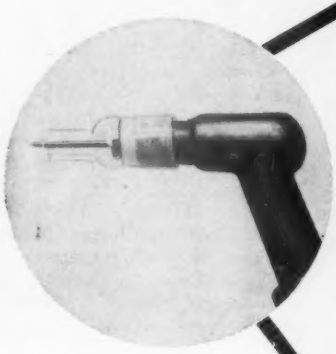
TEC PRESENTS AN UNBEATABLE FORMULA FOR TOP TIG WELDING!

TEC Visuweld Watercooled Torch

The standard bearer of the quality TEC Torch line proven by scores of satisfied users throughout the country.

Lightweight, and maneuverable, the TEC water-cooled operates from 3 to 350 Amps with maintenance free efficiency because of one-piece torch head design which eliminates troublesome wearing or leaking.

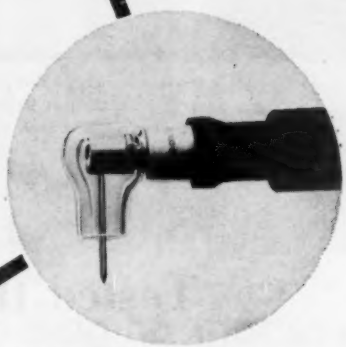
Exclusive "tip-of-torch" water cooling affords continuous welding even at 350 Amps. No finer welding instrument on the market.



TEC Air-cooled Torch

This smooth operating newcomer to the TEC line is gaining plaudits for its great gas savings and its effortless performance.

Rugged and durable due to one piece construction of phenolic plastic reinforced with macerated fiber glass, the TEC Air-Cooled utilizes both standard and off-set Visuweld transparent nozzles.



TEC Spot Gun

Here's the one spot gun that has been engineered not to create problems, but to solve the production gap between resistant welding and arc welding.

Lightweight, "tip-of-torch" cooled, and trouble-free the TEC Spot Gun enables welding all gauge thickness joints from only one side efficiently and economically.

TEC "Tiny Giant" (Pencil) Torch with Off-set Nozzle)

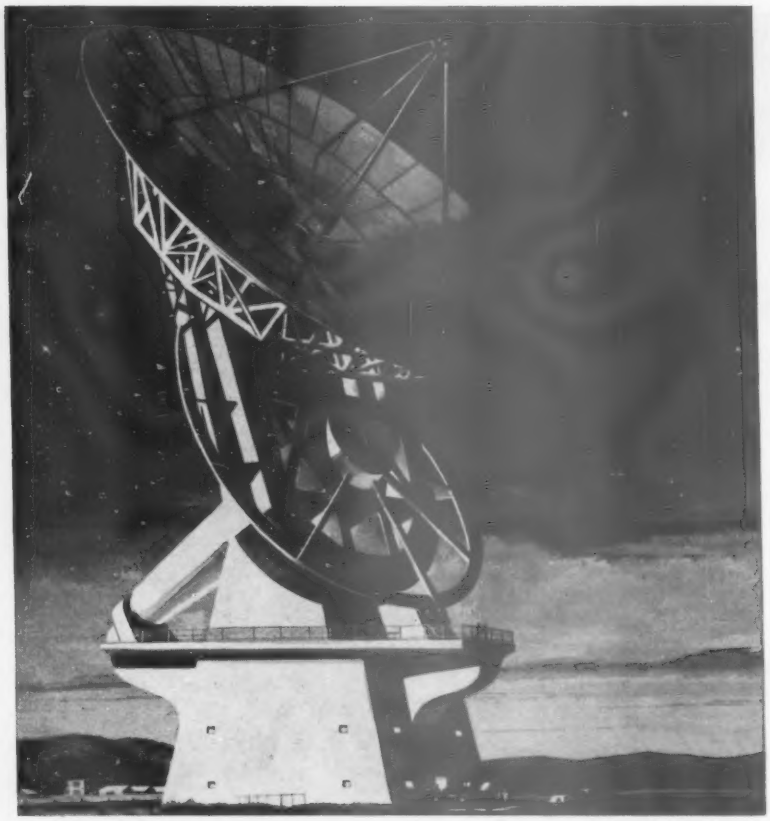
Only the magic of TEC ingenuity could have developed so simple, yet revolutionary an innovation.

TEC's off-set nozzles and chucks convert the TEC watercooled and air-cooled torches into miniature torches which enable TEC TIG welding in less than 1½ inches of space!

You always have the winning formula when you specify TEC for your TIG welding requirements. Dedicated to producing the finest possible equipment in the industry, TEC products have proven time and time again that they out-perform all others . . . that tig welding can be more economical, maintenance free, and can produce results never before achieved. See your nearest TEC distributor today or contact TEC directly for personal service.

** Vycor is a registered trade name of Corning Glass Works, Inc.*

TEC TEC TORCH COMPANY, INC., CARLSTADT, N. J. Manufacturers of Visuweld Equipment



The one-third acre disk of this huge radio telescope, built by E. W. Bliss Co., turns on a 22 foot support bearing. Sperry ultrasonic testing was used to search the bearings' eight 4 inch plates for laminations and to thoroughly probe the vital welds.

Sperry Ultrasonics Tested the Key Welds

Whether it's this giant radio telescope, a gas transmission line or a vital pressure vessel, the nondestructive testing of key weldments has become standard procedure.

This is a major reason for Sperry's planned expansion in nondestructive test equipment. Both the new Sperry services are of the highest quality. Triplett & Barton X-ray offers light weight (the transformer head of the 300 KV model weighs less than 70 lbs.), continuous duty cycle, and high power (up to 300 KV with a full 10 milleamperes output). Sperry SONOFLUX® magnetic particle systems offer the exclusive features of infinite current control and fast, two second demagnetization.

Sperry is fully equipped to evaluate your weld inspection problem and advise the best solution.

Sperry
ULTRASONIC TESTING
INDUSTRIAL X-RAY
SONOFLUX®
MAGNETIC PARTICLE

Sperry Products Company
DIVISION OF HOWE SOUND COMPANY
1508 Shelter Rock Road, Danbury, Connecticut

Martin

Patton

Herbert L. Martin has been named field representative for Arcair Co., Lancaster, Ohio, in the central states. His duties will include working with the company's distributors and a wide range of industries in that area.

Named regional manager of the central sales region of Ransome Co., Scotch Plains, N. J., is *P. J. Patton*. He has been assigned to a new office in Pittsburgh, to cover Pennsylvania, Ohio, Tennessee, Kentucky, Michigan, and upstate New York.

Recently appointed manager of mechanical and pressure tubing products for National Tube Division of United States Steel Corp., Chicago, is *James E. McDonald*. He has been with the division since 1948.

J. D. Zook has been appointed manager of product development at Thew Shovel Co., Lorain, Ohio. He succeeds *Quincy J. Windsor*, who recently retired.

John C. Kaluzny has joined American Machine and Foundry Co., Buffalo, N. Y., as a welding engineer. In his new position, Kaluzny will direct all welding activities at the Buffalo works. He was formerly process engineer with Air Reduction Sales Co., New York City.

Recently retired is *Charles D. Cooper*, an AWS member since 1920, and an employee of Metal & Thermit Corp., New York City, for 30 years. At a dinner held in his honor Cooper (left) is shown with *Hugh D. McLeese*, M & T vice president.

NEW! ANSCO SUPERPAK

for the first time, a new x-ray film packaging that saves time and lowers costs at no sacrifice in quality.

Interrupting operations to open small quantities of X-ray film? Handling many small packages and wrappings? Never again with Ansco SUPERPAK. New Ansco SUPERPAK® is the modern way to increase your efficiency through 600 non-interleaved sheet or 300 interleaved sheet packages of Superay 'A' or Superay 'B'.

Whenever the storage bins (SUPERPAK fits standard film storage bins) need refilling, pause for a moment to open SUPERPAK, work on until the job is completed without further interruptions. Just think of the savings in man-hours and money through this new, sensible method of packaging.

Ansco
Superpak

From every point of view; money, time and general efficiency . . . it makes sense to use SUPERPAK. Ansco, Binghamton, N. Y., A Division of General Aniline and Film Corporation, Manufacturer of World Famous Superay X-ray Films.

Announcing 8 NEW

SILICON POWERED WELDERS

THE MID-STATES *Sil-A-Tran*

3 PHASE DC RECTIFIER

The first 3 phase SILICON Rectifier with electric control of amperage. Has wide range of current and three position range switch with generous overlap. Reversing Polarity switch is standard equipment. *Hermetically* sealed SILICON Rectifiers prevent contamination. Non-aging characteristics of SILICON develop full power output for life of machine. High 98% efficiency of silicon cells provides smooth arc stability. Forced air ventilation and thermal safety switch prevents overheating.

200-300-400 Amp
60% Duty Cycle

200-300 Amp
60% Duty Cycle

THE MID-STATES *Magna-Tran*

AC/DC INERT GAS ARC WELDER

New PLUG-IN timer control: pre-flow — post flow — high frequency drop out and SPOT-ARC. Convert to inert gas welding in the field by plugging in proper timer. SILICON FULL WAVE RECTIFIERS provide superior welding performance on D C application. Patented saturable shunt transformer permits remote and panel control of amperage by rheostat dial. No moving parts reduces maintenance. Indicating light to show operating functions. Panel mounted high frequency assembly for ease of adjustment and maintenance.

THE MID-STATES *Viking* AC/DC

SINGLE PHASE ARC WELDER

Patented movable shunt dual coil transformer provides stepless current adjustment. SILICON Rectifier may be factory installed or field installation may be made at a later date. Full 75 volt open circuit starts arc instantly with all types of electrodes. Sturdy all weather baked enamel case. Smooth stable arc over entire range. Skid mounted — three wheel truck available.

200-300-400 Amp
60% Duty Cycle

Dealer Inquiries Invited

MID-STATES WELDER MFG. CO.

6025 South Ashland Ave. Chicago 36, Ill.

Appointed manager of missile manufacturing at the Downey plant of Aerojet-General Corp., Downey, Calif., is *W. J. Wiley*. He was previously serving as manager of production programming and control for the company.

Stanley E. Fey has been named general manager of K-G Equipment Co., Inc., Allentown, Pa.

George W. Ireland has been appointed manager, general order and merchandise inventory department, of the Houston plant of Joseph T. Ryerson & Son, Inc., Chicago. He has been with the firm since 1944.

Maguire

Schumacher

Uni-Flex Mfg. and Engineering Inc., Los Angeles, has selected *Edward L. Maguire* as manager of cryogenics. In this capacity he will co-ordinate and administer all engineered sales for the company's line of cryogenic equipment.

Frank A. Schumacher has joined Beaver Welding Supply Co., Memphis, as sales and dealer representative.

In a reorganization of public relations functions at Crucible Steel Co. of America, Pittsburgh, *Michael Stumm* has been appointted director of information services and *Leo J. Murphy* has been named manager of community services. Stumm was formerly advertising and promotion manager, and Murphy was public relations manager.

Howard W. Read was elected vice president, marketing, of Alan Wood Steel Co., Conshohocken, Pa. Read succeeds *Perry L. Francis*, who has been elected senior vice president and marketing consultant. In the new position, Read will be responsible for Alan Wood's entire marketing function.

Ransome Loves Those Specials

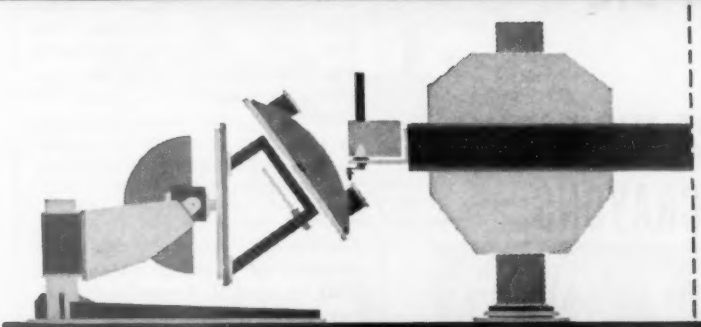
ANOTHER EXPANDED RANSOME SERVICE . . .

"JOB-FITTED" AUTOMATION WELDING EQUIPMENT

Whatever your custom tooling requirements . . . whatever your automation welding requirements — where Ransome standard equipment does not fit the job, **we tool to fit.**

Whether you build an atomic sub or an underground fuel tank, we'd be pleased to show you how Ransome imagineering can help you do the job more efficiently at less cost. Whatever your welding positioning need you can expect the new, the different, the better from Ransome! Ransome designers and engineers will job-fit to do the job you want done!

Give Ransome your toughest job . . . let us prove our experience will pay off in profits for you. Please call or write today.



Ransome Company, Scotch Plains, N. J.

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- ☐ Have your sales engineer contact me.
- ☐ My positioning problem is.....

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Ransome Company

. . . MACHINE TOOLS FOR WELDING . . .

Division of Big Three Welding Equipment Co.

Scotch Plains, New Jersey

RANSOME . . . THE PIONEER IN POSITIONING FOR WELDING

WHATEVER YOUR NON-DESTRUCTIVE TESTING PROBLEM

CONTACT—Curtiss-Wright, the world's most complete source for non-destructive testing engineering and equipment.

RESULT—Unbiased recommendations as to the testing method best suited to your particular operation.

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TEMPERATURE-INDICATING PAINTS AND CRAYONS

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SWinburne 9-0500

In Canada contact
CANADIAN CURTISS-WRIGHT LIMITED, 1980 SHERBROOKE STREET WEST, MONTREAL, P.Q., CANADA

Metallurgist *Hiram Brown* has joined the staff of Battelle Memorial Institute, Columbus, Ohio. Previously, he was a technical advisor at Solar Aircraft Corp. and general manager of its Des Moines, Iowa plant.

Gulf Coast and Cleveland area sales representatives for its welding and portable lighting and power distribution equipment and systems have been named by J. B. Nottingham & Co., Inc., New York City. *Charles Petty, Jr.* will represent the company from Mobile, Ala., through Houston. *Floyd Davies* will work in and around Cleveland.

Recently retired from active service as senior vice president of Crucible Steel Co. of America, Pittsburgh, is *Walter H. Wiewel*. Wiewel will continue with the firm as a consultant.

Ampco Metal, Inc., Milwaukee, has elected *J. P. Henry* a director and *Henry C. Fechtmeyer* a vice president. Henry is also vice president and general sales manager, and Fechtmeyer is secretary and controller.

Died . . .

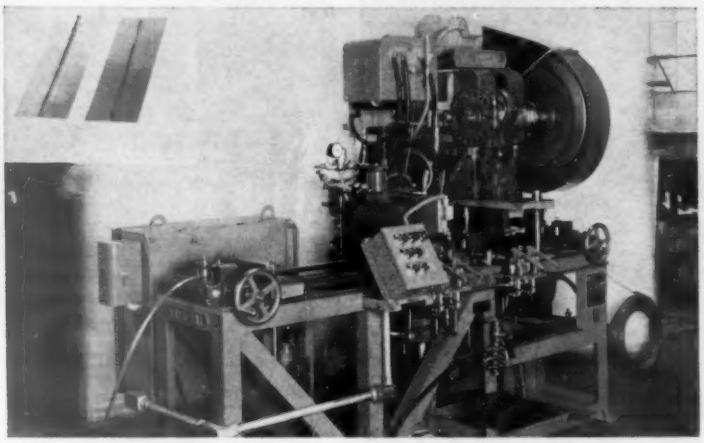
Irving B. Hexter, president of The Industrial Publishing Corp., Cleveland, died May 22 at the age of 62. Mr. Hexter founded his firm 30 years ago when he started publishing "Industry & Welding"—now "Welding Design & Fabrication." He is survived by his widow, a daughter and grandchildren.

Ralph A. McKinney, 90, retired sales executive of Manhattan Rubber Div., Raybestos-Manhattan, Inc., Passaic, N. J., died on April 17 at his home in Cleveland. Mr. McKinney, who joined Raybestos in 1911, organized the company's first central region with headquarters at Pittsburgh.

Charles T. Young, also 90, and a member of Raybestos-Manhattan died on April 2. Active in the rubber industry for 62 years, Mr. Young was associated with many pioneers in the field. He is credited with early experiments with Mexican guayule shrub rubber and Manhattan's commercial use of it. He was factory manager at the Passaic plant until his retirement in 1946.

New products

. . . use card on page 107



Strip welder

Semiautomatic strip welder uses Tig welding to join ends of rolling mill strips in a wide range of strip thicknesses and width. Manufacturer says machine offers maximum versatility at low cost in handling strips 1-in. to 8-in. wide and 0.020-in. to 1/8-in. thick. Tooled with a Mig welding head the unit will handle material up to 3/8-in. thick. Weld speeds of 20-in. per minute on 0.020 stock and six ipm on 1/8-in. material are obtained, according to firm. Work is squared on a motor-operated shear which cuts trailing and leading edges on a 15 deg bias. Air-operated auxiliary clamp beyond the weld station holds the trailing strip for shearing. Standard Tig welding torch with concentric argon shield is slide-mounted and air operated for controlled motion across the joint. Torch slide, manually adjustable for proper electrode height, is exactly parallel with the copper backup to control arc length. *National Electric Welding Machines Co.*

Circle No. 8

Ultrasonic cleaning

Based on unique, sandwich-type transducer, ultrasonic cleaning system is said to offer greater efficiency for many applications than those using magnetostrictive or barium titanate transducers. Lead zirconate titanate transducer, heart of the new system, may be operated as a full-wave system, thus doubling the effective power output per unit area. It also offers higher permissible operating temperature (200 F). *Branson Ultrasonic Corp.*

Circle No. 9

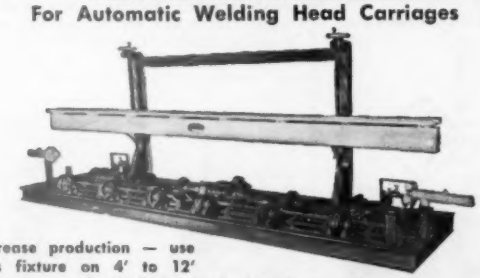
Horizontal grinders

Smallest of a family of general purpose horizontal grinders are only 10 in. long and weigh 40 oz. Among design features are all-steel housing, including a steel front head for additional strength and resistance to abrasive wear, shielded bearings to improve grease retention and prevent possible entry of foreign particles, and rotatable baffle ring and muffler to reduce noise level. Tools operate at 20,000 rpm, require ¼-in. ID hose and 90-100 psi pressure. *Buckeye Tools Corp.*

Circle No. 10

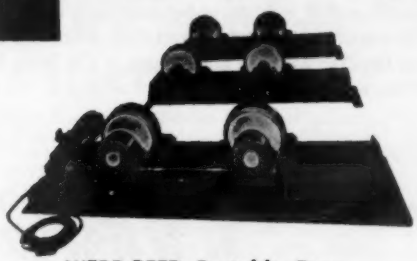
WEBB TANK PRODUCTION MACHINERY

WEBB-REED TRACK SUPPORTS
For Automatic Welding Head Carriages



Increase production — use this fixture on 4' to 12' diameter work. Welding track is 24' to 34' long. Powered vertical adjustment is available for all models. May be used with your present turning rolls, welding positioners, special jigs for straight seam work, or portable type rolls illustrated.

Horn Type Fixtures | Cylinder Flange Offsetters | Assembly Fixtures



WEBB-REED Portable Type TURNING ROLLS

For manual or automatic welding and other operations requiring rotation of a cylindrical vessel. Capacities range from 3 to 75 tons; larger units built to special order. Powered by electric motor with variable speed transmission. Readily portable, they may be used free or anchored to the floor as desired.

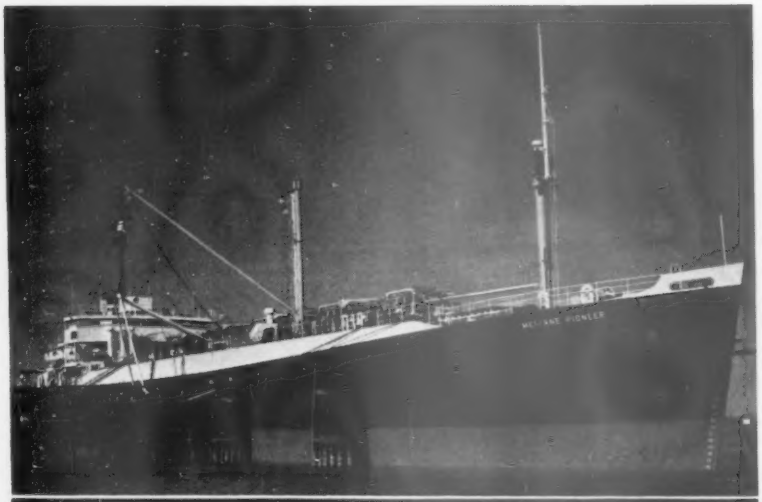
Unit Type Turning Rolls

Portable Turning Rolls

Automatic Welding Track Supports

Write for illustrated literature

Since 1881 THE REED WEBB CORP.
EQUIPMENT DIVISION
WEBB CITY, MO., U.S.A.



Job report courtesy of Conch Methane Co., Ltd.

when pipe joints must be completely dependable at minus 258°F

The engineers who successfully "broke through" the problem of handling liquefied methane gas on and off the "METHANE PIONEER" at minus 258°F had to "play it safe" in every respect. To provide unquestionably *safe* stainless pipe joints, Arcos EB Consumable Weld Inserts were used to make the important root passes.

EB Inserts permit welding to be done from one side only. They eliminate back-up ring obstruction and produce a smooth inside contour to expedite gas flow. If you are not familiar with the advantages of EB Weld Insert for "tough" pipe joining problems, write ARCOS.

*Trademark of General Dynamics Corp.

WELD WITH ARCOS

EB* WELD INSERT

ELECTRODES • WIRE • FLUXES
SEMI-AUTOMATIC AND AUTOMATIC EQUIPMENT FOR WELDING
STAINLESS • LOW ALLOY • ALUMINUM • MILD STEEL

ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

Welding helmet

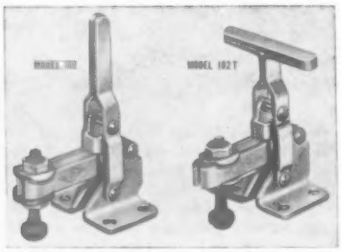
Recently developed helmet eliminates lifting from the face for work inspection. Protective eye guard lifts from view with workman's jaw motion, leaving a clear plastic area for viewing. Helmet, of standard fibre construction, is adjustable. Safety factor is said to be high as weldor may work in restricted areas and will not create hazards to himself or others. *Auto-View Welding Helmet Co.*

Circle No. 11

Portable nibblers

Cutting capacities of portable nibblers range up to ¼-in. cold or hot rolled steel and 5/16-in. aluminum. Both air and electric powered models are available for cutting all non-ferrous metals such as copper, brass, aluminum, 10-gage stainless steel and corrugated metal. All models feature hardened gears and anti-friction bearings on all rotating parts. *Fenway Machine Co., Inc.*

Circle No. 12



Toggle clamps

Miniaturized, vertical-handle toggle clamps have rated holding pressure of 100 lb, are furnished with neoprene-tipped spindles. Designed principally for light-duty assembly operations, they are available with either a straight vertical handle or "T" handle. Base holder center distances are spaced to fit aircraft and electronic pegboard assembly fixtures. *Detroit Stamping Co.*

Circle No. 13

Splice welder

Splice welder permits a much higher number of welds per second and significantly higher weld quality than conventional methods, says manufacturer. New unit was specifically designed for high-speed precision splicing of structurally critical honeycomb core materials. Unit comes complete with power-operated tweezer head, solenoid valve, air pressure regulators, tweezer head support beam and all necessary cables and connectors. Weld pulse is automatically controlled, and adjustable mechanical pressure is provided by an air cylinder. Basic unit, contained in a 22 x 12 x 15-in. portable cabinet, operates on standard electrical and compressed air outlets. Electrical requirements: 230 volts, 60 cycle single phase with a source capable of supplying peak currents of 50 amp and an average current of 15 amp. *Hexcel Products, Inc.*

Circle No. 14

Cart-mounted Mig welder

Cart-mounted welding machine uses any shielding gas, including argon, helium, CO_2 or mixtures, handles all popular wire diameters, either solid or cored. Adaptable electronic controls, primarily designed for the constant-potential power source, are easily converted to use conventional power supplies. Optional control features include a wire-feed delay until the arc is struck, and continuous operation without depressing the torch trigger. *Linde Co.*

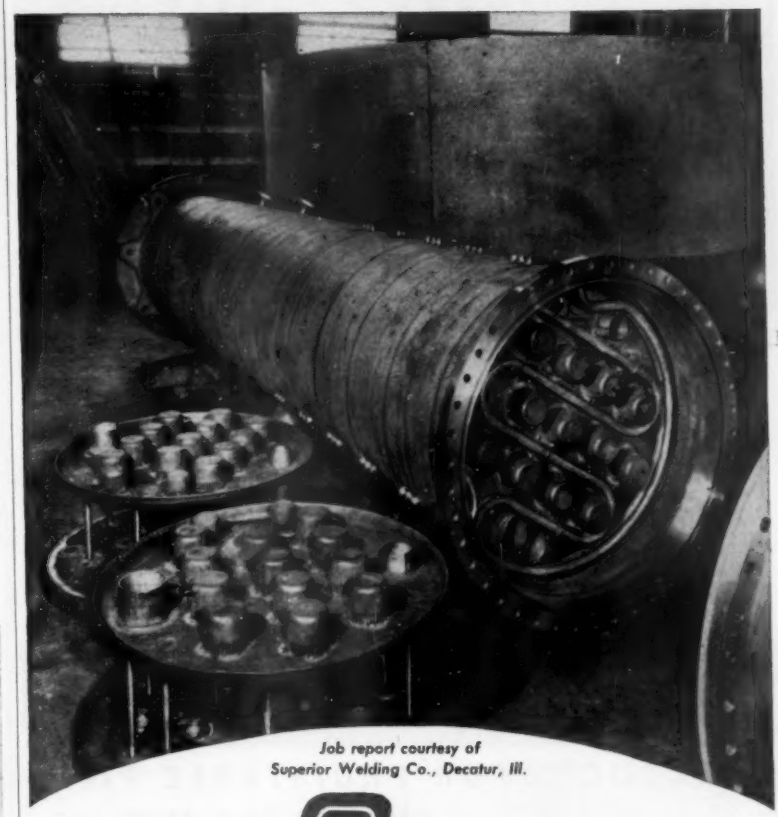
Circle No. 15

Contact wheel

R-100 contact wheel for grinding and polishing with coated abrasive belts and bands features rubber molding between two prime steel discs that form wheel sides. All wheel arbor holes are standard, but the aluminum or steel flanges that are inserted into the wheel arbor holes are machined with precision to the diameters required. Available in durometer ranges from 10 to 90, has oil resistant tires with plain or serrated faces and can be used for wet or dry operations. *Cosmo Wheels, Inc.*

Circle No. 16

When corrosion is a threat to the life of Stainless Welds



Job report courtesy of Superior Welding Co., Decatur, Ill.

WELD WITH ARCOS

STAINLESS ELECTRODES

This is a nitric acid absorption column for the chemical industry. The shell and flanges of solid 304 ELC stainless were welded with Arcos CHROMEND 19-9 Cb Electrodes to resist chemical attack at 150 p.s.i.g. and 300°F. Arcos CHROMEND K-LC Electrodes were used for welding the bubble caps and coil clips. Together, these two Arcos Electrodes proved the point: there's no substitute for quality weld metal when long uninterrupted service is essential. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

no matter what the two metals are . . .

now you can **SOLDER** them

PROBLEM:
Joining copper pipes in extremely hard water area. Lead solders made porous joints. Heat required for high temperature solders burned copper pipes.

SOLUTION:
All-State's #430, a silver-bearing solder which flows at 430F, made perfect, permanent joints, solved the problem.

ALL-STATE has a solder for joining any commercial metal or alloy to any other . . . in one or more temperature ranges. For typical examples, see tables below:

400°F-500°F							700°F-800°F					
Al.	Copper	Brass	Steel	S.S.	Nickel		Al.	Copper	Brass	Steel	S.S.	Nickel
37	107	107	107	107	107	Aluminum	56	105	105	105	105	105
107	430	430	430	430	430	Copper	105	105	105	105	105	105
107	430	430	430	430	430	Brass	105	105	105	105	105	105
107	430	430	430	430	430	Steel	105	105	105	105	105	105
107	430	430	430	430	430	Stain. Steel	105	105	105	105	105	105
107	430	430	430	430	430	Nickel	105	105	105	105	105	105

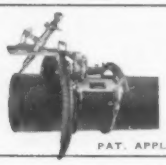
Reference numbers above indicate All-State solder to be used for joining metals.

A set of four complete tables, covering temperature ranges from 400F to 800F, is yours for the asking. Send for free Instruction Manual, too.

Distributor-Stocked, convenient to buy. Economical to use.
ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.
Call WHite Plains 8-4646 or write for nearest distributor

PRODUCTS FOR PROFITABLE PIPE CUTTING AND BEVELING

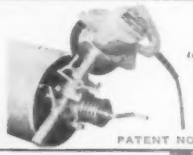
STD. MACHINES



PAT. APPLIED FOR

FAST, accurate cutting and beveling of all sizes of pipe from 1½"-36". Simple operation . . . operator can master machine in a matter of minutes.

"BEVEL-LAND" GRINDER



PATENT NO. 2,869,293

No more time consuming handwork. "BEVEL-LAND" smooths pipe cuts and accurately places the lands on bevels in a matter of seconds.

OUT-OF-ROUND

Insures even, accurate cuts of irregular pipe. Roller rides pipe surface . . . makes cutting easy, simple. Fits all H&M Machines.

PATENT NO. 2,843,373

SHAPE CUTTER

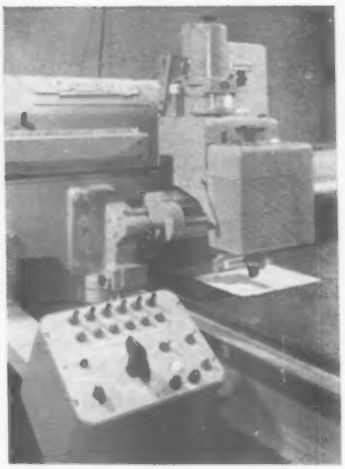
Accurately cuts saddles, tees, els and other irregular shapes. Lightweight, extremely portable . . . fits all H&M Machines.

PATENT APPLIED FOR

WRITE FOR CATALOG SHEETS AND PRICE LISTS ON THE COMPLETE H&M LINE.

H&M
TM Reg

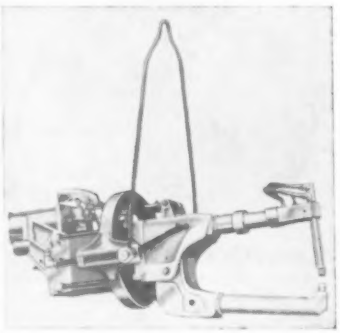
PIPE BEVELING MACHINE COMPANY
311 E. Third St. DI 3-0241
TULSA, OKLAHOMA



Tracer system

Shape-cutting machine is equipped with photocell tracer with built-in kerf adjustment. Simple pencil or ink sketches of metal shapes and forms are used to guide the tracer, which eliminates need for expensive metal or plastic templates. Tracing accuracy is plus-minus 0.005 in., according to manufacturer. Device can negotiate 90 deg turns with 1/16-in. radius at speeds up to 16 imp and 90 deg turns with 1/8-in. radius at speeds up to 27 imp. Template may be engaged manually or by use of remote control. *Linde Co.*

Circle No. 17



Spot welder

Latest addition to line of spot welding guns works on 18,000 amps, 1,350 lb pressure. It is air operated, fully automatic, water cooled, and will weld from the lightest gage up to 2 x 3/16-in. metal. Equipped with gyroscopic suspension for easy rotation in all directions. *Aro Spot Welders, Div., Guthery Machine Tool Corp.*

Circle No. 18

Hardfacing electrode

New composite 14% manganese hardfacing electrode is suitable for build-up of railway manganese frogs and switches and for dipper teeth, bucket lips, crusher hammers, jaws and screens in the heavy construction industry. Hardness as-deposited ranges from 170 to 230 Brinell and it will work harden to 550 Brinell. Available in standard 14-in. lengths in diameters of ⅛, 5/32, 3/16, and ¼ in. *Air Reduction Sales Co.*

Circle No. 19

Fume precipitator

Compact, self-contained mist and fume precipitator removes oil mist, smoke and fumes from air exhausted from industrial operations such as machine tools and welding booths. Unit contains a blower, a filter and an electrostatic precipitator which remove the pollution from the air, which, when it is exhausted from the precipitator, is recirculated to the shop. Device is available in two sizes—one rated at 600 cu ft per minute capacity and the other rated 1,200 cu ft per minute. *Air-Maze Corp.*

Circle No. 20

Lifting tools

Three types of lifting tools transfer, pull, turn over, rotate and position many jobs, including metal sheets, plates, blocks, slabs, weldments, castings, machine assemblies, pipe, tubing, etc. Flexible frame action, toggle action, and floating circular wedge action combine to afford a tenacious grip, claims manufacturer. *James Campbell Smith, Inc.*

Circle No. 21

Stud welder

Special automatic high speed stud welding machine which cuts costs by enabling simple machine screw products to be used as studs. Cold-heading process used to produce flanges is eliminated. The unit, a four station index machine, can handle approximately 200 pieces per hour with 80% efficiency. *Progressive Welder and Machine Co.*

Circle No. 22

NEW! WILTON'S C-CLAMP·O·RAMA

A complete line built around WILTON quality!

NEW! Series 100 Heavy duty, standard throat depth, (forged steel).
NEW! Series 200 Commercial duty, standard throat depth, malleable alloy.
NEW! Series "D" SUPER DUTY Heavy duty, forged steel.
Series 400 Regular duty, extra deep throat, forged steel.
Series 500 Regular duty, standard throat depth, ductile alloy.
Series 600 Quick acting, modern design, ductile alloy.
Series 900 Heavy duty, standard throat depth, ductile alloy.

PERMA-PAD SWIVELS Guaranteed never to come off!
FIRE BATH PROCESS! Special hardening process.
INDIVIDUALLY BOXED Easy to handle, clearly marked! WE-60

WILTON WILTON TOOL MFG. CO., INC. SCHILLER PARK, ILLINOIS
SOLD BY LEADING INDUSTRIAL SUPPLY DISTRIBUTORS EVERYWHERE

Eliminates Spatter Grinding After Welding

YORK'S SPAT-R-PRUF COMPOUND 106

THREE EASY STEPS

1. Coat Surface
2. Weld
3. Wipe Off

A perfect paint base. No stirring or dilution necessary. No grinding after welding—spatter can be wiped away with a dry cloth.

IMPORTANT FEATURES

- Non Toxic
- Non Inflammable
- Pleasing Odor
- Harmless to Skin
- Helps Prevent Rust
- No Weld Porosity

Available in 1 gallon cans and 5 gallon cans and 55 gallon drums.

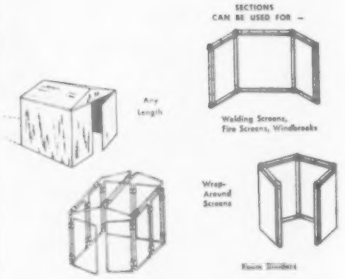
3-IN-1 YORK'S '77' SPECIAL FLUX

- For General Brazing
- For Cast Iron Welding
- For Cast Iron Brazing

A guaranteed bond even under toughest conditions.
Available: 1 lb. Cans

YORK ENGINEERING COMPANY
2711 S. KEDZIE AVENUE • CHICAGO 23, ILLINOIS

DOC TUFFY
TO THE RESCUE
NO-NO-NOT ANOTHER LEAKER!
ALL OUR EJECTOR HOLDERS LEAK, DOC! AND I'M NOT MISTREATIN' 'EM—I'M NOT!
JOE'S NO PSYCHO, MR. FOREMAN. WHY NOT LET HIM TRY A GOLDCROWN?
GOTCHA, DOC! JOE'LL HAVE A GOLDCROWN TOMORRA!
New Tuffaloy Goldcrown Ejector Holder ends leakage. Seals are protected from shock and grit. One Goldcrown user made 25 million welds without a leaker.
Goldcrown man-size ejector head ends sticking. For Goldcrown details write your nearby Airco or Tuffaloy office.
TUFFALOY.
AIRCO
AIR REDUCTION SALES COMPANY
A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.
Air Reduction Pacific Company • Air Reduction Canada Limited



Screen panels

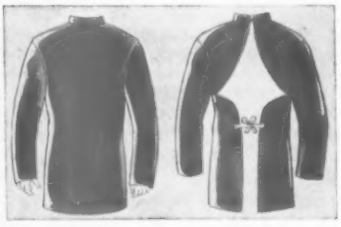
Newly designed series of screens includes 6 x 6 x 7-ft hut which can be assembled in minutes with eight standard frames to form the side walls and two to form the top. Standard clamp hinges permit panels to be hinged for doors. Frames are made of durable steel tubing panels with U. L. approved fabric curtains. *Frommelt Industries.*

Circle No. 23

CO_2 manifolds

Line of CO_2 manifolds which prevent regulator freeze-ups while helping cut gas consumption during welding operations are made in different sizes for two- and four-bottle systems. Both manifolds are self-contained, one-piece units designed to work with any set of standard regulators, and come equipped with all necessary fittings, gaskets, and electrical wiring. Heating is accomplished by an electrical element built into the manifold. Smaller unit has two input gas ports and one outlet for connection to valves and gages; larger manifold has four input ports to facilitate higher volume welding production in shops and areas where built-in CO_2 service is not available. *World Electric Co.*

Circle No. 24



Lightweight clothing

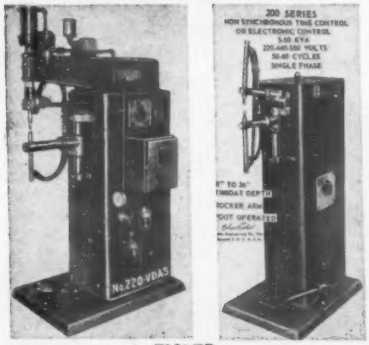
Cloth clothing offers protection where the danger of heat, flame or solder splashes are present. Made of flame-resistant finely woven cotton twill, garment is available in capes with bib, bib aprons and full jackets. *Singer Mfg. Co.*

Circle No. 25

EISLER VERTICAL TYPE PRESS WELDERS

We also make a complete line of Spot and Wire Butt Welders.

Write for Cat. No. 93-57



EISLER ENGINEERING CO., INC.

Charles Eisler Jr., President

749 So. 13th St., Newark 3, N. J.

QUIK-HEAT

up to 2200° F.

CLEMENTS

Cadillac

MODELS K3 & M2

BLOWTORCHES

Here are rugged, high efficiency blowtorches that speed up all types of heat treating and production operations. These two Clements Cadillac Blowtorches provide heat up to 2200°F. in seconds and are fully portable.

With the Clements Cadillac model K3 or M2 you can bring the torch to the work instead of the work to the torch as in fixed installations. Furnished fully equipped with sturdy, high stability stand. Easily adjustable for height and direction of torch.

Operates on natural, manufactured, or LP-gas.

CLEMENTS MFG. CO.

6643 S. Narragansett Ave., Chicago 38, Ill.

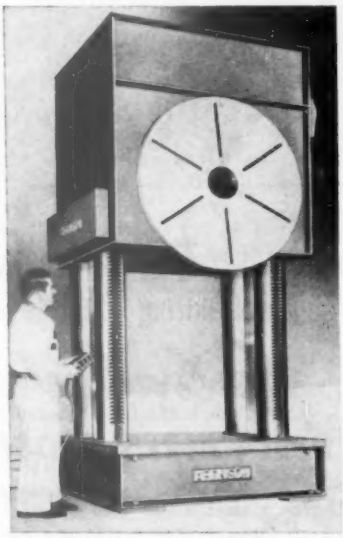
SINCE 1910

INDUSTRIAL PRODUCTS DIVISION

Control units

In addition to d-c metallic arc welding with coated electrodes in all positions, multi-arc control units may be used for other types of electric welding, including the gas shielded tungsten arc and consumable electrode process. Switches on front of each drawer in unit allow operator to vary the current in steps as small as one amp. Enclosed in welded steel frame with expanded-metal bottom and side panels and a solid steel top with side louvres for additional ventilation, the units are completely convection cooled and require no fans. *J. B. Nottingham & Co., Inc.*

Circle No. 26



Elevation positioners

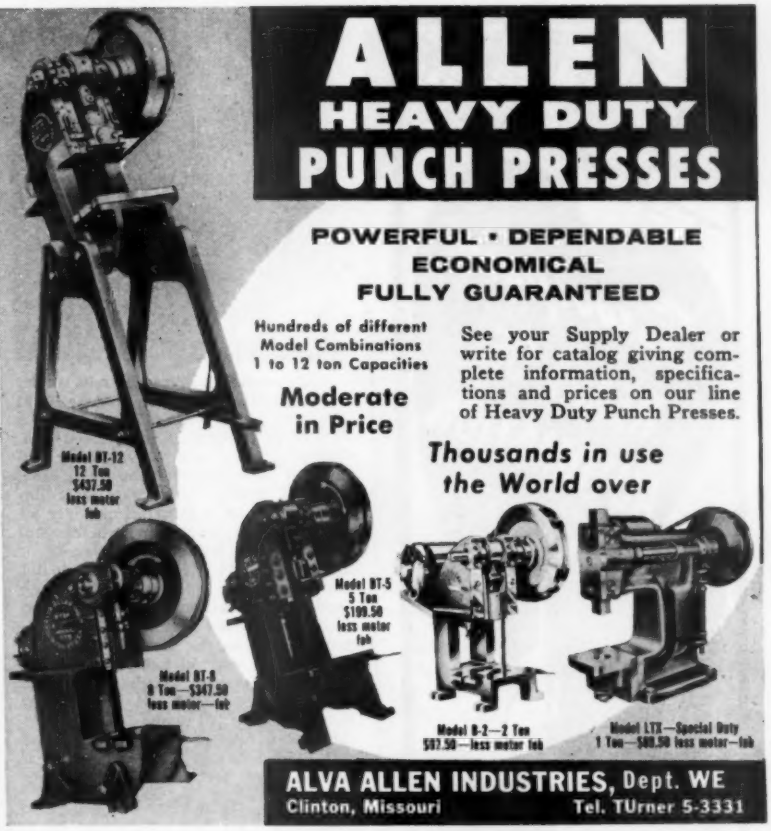
Heavy-duty geared elevation head and tailstock positioners are used for positioning weldments such as freight and piggyback cars for down-hand welding. Low horizontal axis height keeps weldment near floor, while elevation feature enables clearance for indexing. All models have hollow spindle to allow for passage of cables, gases or fixturing and have a full complement of accessories. *Aronson Machine Co., Inc.*

Circle No. 27

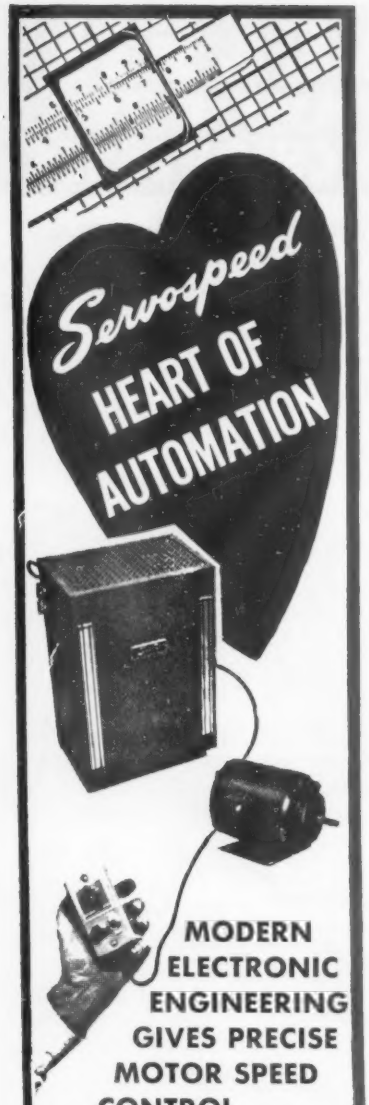
Abrasive unit

Abrasive belt head unit is especially designed for polishing contours, but also adapts to flat work. Air cylinder maintains and adjusts belt tension on the tracking pulley. Wide spacing between two idler pulley permits polishing of sharply contoured work since the belt has more opportunity to retrack itself. Belt length is 132 in. *Divine Bros. Co.*

Circle No. 28



HIGHEST YIELD
They mean National Carbide's calcium carbide —gets ten tests!
Always nearby— in the BIG RED DRUM. Wire for supplier...
NATIONAL CARBIDE COMPANY
A DIVISION OF AIR REDUCTION COMPANY, INC.
150 East 42nd Street, New York 17, N.Y.



MODERN ELECTRONIC ENGINEERING GIVES PRECISE MOTOR SPEED CONTROL

1/100 — 10 H. P.

Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.

Servospeed
DIV. of ELECTRO DEVICES, Inc.
4 Godwin Ave., Paterson, N. J
ARmory 4-8989

Butt welder

High-production, precision butt welder is designed for speed, stamina, and simplicity, say manufacturers. Model B10 is an automatic, air-operated unit. Clamping jaws are actuated by individual air cylinders to assure positive clamping action. Upset pressure is also air operated by a third independent air cylinder with complete control of both the upsetting pressure and degree of upset. Non-critical automatic actuator has been built into unit, eliminating need for critical air pressure switches used on previous machines. It is only necessary to set the jaw clamps for the thickness of material being welded, set the current control switch for the degree of heat required and begin operation. Machine includes, as standard equipment, two air pressure regulators with individual gages and air line oilers, air line filter, and one set of clamping jaws and welding dies. *Peer Inc.*

Circle No. 29

Spray gun

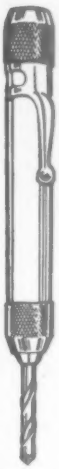
Spray gun will permit use of rods up to ¼ in. in diameter, including rods of aluminum oxide, zirconium oxide, chrome oxide, zirconium silicate and other ceramic compositions. Auxiliary air supply gives additional pressure right at the nozzle so that angle of projection never before possible can be attained, states manufacturer. *Metallizing Co. of America.*

Circle No. 30

Taper-face flanges

Line of lightweight carbon steel taper-face welding neck flanges has been expanded to include 14-in. through 24-in. pipe sizes. New units are rated at 150 psi water, oil, and gas service and 100 psi saturated steam (338 F), conforming to ratings for ASA B16.1 class 125 cast-iron flanges. Slight taper, machined onto the flange face, concentrates gasket contact pressure near the bore and results in a lower required sealing force. *Tube Turns Div., Chemetron Corp.*

Circle No. 31



COMMANDO

DRILL KIT

- Lighter weight—made of aluminum
- 12 High-carbon steel drills the most practical tip-cleaning tool made. Cleans and trues most standard orifices. Contains even-numbered drills from size 52 to 74. Room for extra drills in case.

OTHER COMMANDO PRODUCTS

★ Replacement drills
★ Lighters and flints
★ White metal welding rod
★ Goggle head bands
★ Ferrule crimper
★ Soapstone holders

Buy at your local welding supply dealer

J. M. EAGLE INDUSTRIES COMMANDO

2715 OAK STREET • KANSAS CITY 8, MO.

No Other Product Can Do a Galvanizing Job Like

Galvalloy

Does - *HERE'S PROOF*

Rub GALVALLOY against heated surface as shown — now spread with wire brush for a bright finish.

GALVALLOY Covers the Same Amount of Area with 1/5 the Amount of Material.

Send today for Testing Sample and you'll learn Why GALVALLOY has no equal for ANY Galvanizing Job.

METALLOY PRODUCTS CO.
1233 S. BOYLE AVE., LOS ANGELES 23

HANDLE

- CYLINDERS
- TANKS
- EQUIPMENT

EASILY, QUICKLY AND SAFELY WITH

AUTO CRANE

Now one man with suitable model AUTO CRANE can perform work presently being done with larger equipment — *and do it in less time, with less help and with greater safety!*

Approved by insurance safety committees, battery-powered AUTO CRANE rigs up fast. All models feature a combination of hoist and boom which makes it *the most versatile handling equipment on the market today!*

Write today for illustrated literature, specifications and price lists on all models of AUTO CRANE.

AUTO CRANE Company

1214 S. NORWOOD • TULSA 12, OKLA.

Never a strain with Auto Crane

Portable bender

Precision bending of sheet metal and wire into virtually any shape or form is possible with portable bender, says producer. The tool, which can exert up to 2,000 lb pressure, can bend sheet metal up to 1/8-in. thick x 1¼-in. wide. Made of heat treated steel, case hardened, zinc plated device can be held in the hand or clamped in a vise. *The Hahn Co.*

Circle No. 32

Automated welder

New 6-station rotary index automated welder combines assembly, CO_2 shielded arc welding, reaming and spotfacing operations. Unit assembles a spacer into bracket assembly (in production of motor mount brackets), welds the spacer to the mount in a 360 deg rotary operation, and simultaneously reams the inside diameter of the spacer. Index table is driven by a standard cam index drive. Standing 12 ft high, the unit occupies floor space of 6 x 10 ft, and is electrically sequenced and air operated. Welding current is supplied by a 500 amp rectifier. *Expert Welding Machine Co.*

Circle No. 33

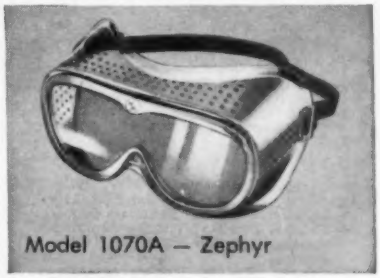
Weldor's glove

Imported carpincho is leather used in new line of welder's gloves. Soft, supple material resists heat shrinkage. Extra wide reinforcement is provided in thumb crotch, point of greatest wear in most welding jobs. Available in 13½-in. gloves and mittens. *Singer Glove Mfg. Co.*

Circle No. 34

THE *NEW* VIEW FOR WELDERS!

WELSH sets the pace in creative design . . . new modern materials and techniques for your more effective eye protection.



WELSH ZEPHYR — New, increased working visibility . . . greater top ventilation! The first major improvement since the origin of the flexible goggle. Choice of five ventilation styles.

WELSH CYCLOPS — A one piece aperture welding goggle . . . flexible frame provide the ultimate in comfort, fit and visibility. Simplified lens holder permits easier changing of filter and cover plates.

WELSH SOFT-I — Cushion-fit eye protection featuring unique, soft, pliable frame cover goggles. Deep cuts fit easily over largest prescription goggles.

WELSH — *Willingly Worn by Workers Everywhere*

WELSH MANUFACTURING COMPANY

9 MAGNOLIA STREET, PROVIDENCE, R. I.

NO INJURIOUS FUMES . . .

ANTI-BORAX

No. 2 BRAZING FLUX

For Brass, Bronze, Copper, Steel, Malleable Iron, etc. Causes the bronze to penetrate deeper into the joint—making a stronger union than is possible with other fluxes. High efficiency makes it more economical to use. Melting point 300°.

ALSO

1—Cast Iron Welding Flux
3—Brass, Bronze Welding Flux
4—Flux for Bronze Welding Cast Iron
5—Extra Quality Aluminum Flux for Cast Aluminum Welding
7—Steel Flux
8—Aluminum Flux for Sheet Aluminum
9—Stainless Steel Flux
11—Tinning Compound
12—Burnt Cast Iron Welding Flux
13—Brazing Flux for Extruded Bronzes
14—Special Brazing Flux for Aluminum Bronze, Everdur, and all Silicon Bronzes
15—Special Flux for Magnesium Alloys Dow Metal, etc.
16—Silver Solder Paste Flux

FOR THE BEST JOB AT LEAST COST

Welders can save more money and get a better job on production work, making special tools, and repair work with the right Anti-Borax product — **order by number.** Send for **free sample** and descriptive Circular.

ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE, INDIANA

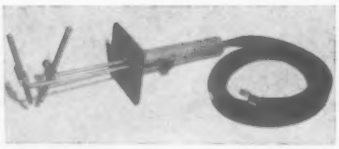
Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

WRITE FOR DETAILED INFORMATION

RUEMELIN MFG. CO.
3880 N. PALMER STREET • MILWAUKEE 12, WIS., U.S.A.
Mfrs. & Engineers • Sand Blast & Dust Collecting Equipment



Torch kit

Twin electrode torch uses two cored carbon electrodes, easily maintained at proper distance, to produce an electric arc for many heating, soldering, brazing, and welding jobs. Operation is economical, according to manufacturer, since it uses only inexpensive a-c welding current. Because no gas is involved, cylinder handling is eliminated. *Arcair Co.*

Circle No. 35

Abrasive disc

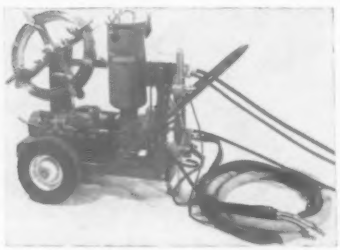
Depressed center abrasive disc produced the lowest overall grinding cost based on metal removed and wheel life, in laboratory and supervised field trials, claims manufacturer. Designed for grinding welds and bevelling edges as well as for notching gates and risers and trimming fins, the discs are available in 7 and 9 in. diameter sizes in 1/8, 3/16 and ¼ in. thicknesses. *Manhattan Rubber Div., Raybestos-Manhattan, Inc.*

Circle No. 36

Manual welders

Line of manual welding machines are designed for a variety of heavy, medium, and light duty a-c and d-c applications, ranging from production jobs to shop work, and involve metallic arc, inert gas arc, and spot welding processes. Most versatile model can be tailored to various applications through the use of timers that plug in like radio tubes. Timing on gas pre-flow, high frequency drop-out and spot arc controlled through this system. Design features include double-wound transformers in all a-c welding machines for balanced output and better starting; sliding shunt mechanism in all heavy duty a-c machines to provide full range adjustment; and hermetically sealed, non-aging, high-efficiency silicon diodes in all d-c rectifiers. *Metal & Thermit Corp.*

Circle No. 37



CO^2 welding

Carbon dioxide magnetic flux welding equipment features a 12-in. diameter coil of welding wire to provide greater mobility and ease of loading. Chassis is a rubber tired, wheeled cart, with a curved handle that pivots to a vertical position so that the machine can be lifted by crane or operated in a suspended position. Two basic torches are available—a pistoltype and a blowpipe type. *Linde Co.*

Circle No. 38

BATEMAN BANTAM IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only.....$495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

When You Weld Cast Iron Select the Correct

Fuse-Well

CAST IRON WELDING RODS OR ELECTRODES

FUSE-WELL NO. 11

FUSE-WELL No. 11, *Square*—Gray Cast Iron Welding Rod for Acetylene use in filling or building up new or worn castings producing machineable welds.

FUSE-WELL NO. 12

FUSE-WELL No. 12, *Round*—Has the same uses and analytical ingredients as Fuse-Well No. 11.

FUSE-WELL NO. 14 MOLY

FUSE-WELL No. 14, *Moly*—An Iron Base Rod with alloys added for finer grain structure and greater strength.

FUSE-WELL NO. 22

FUSE-WELL No. 22, *Electrode* — Light coated Rod to be used for AC or DC welding in the fabricating and repairing of cast iron castings.

THE CHICAGO HARDWARE FOUNDRY CO.
Weld Rod Division
NORTH CHICAGO, ILLINOIS

Photo Courtesy The Lincoln Electric Co.

NOW . . .

ONE AMMETER for AC/DC WELDERS

Only **TONG-TEST** measures both AC and DC

Weld with confidence. Use the exact amperage — no more, no less—to assure welding quality. Prevent costly rejects by controlling the welding current (AC or DC) with one TONG TEST AMMETER. Simply snap tongs around electrode cable — read amps instantly and accurately. No electrical connections required, cannot burn out. Interchangeable ranges up to 1000 amperes.

Write for Catalog WE-400

COLUMBIA ELECTRIC MFG. CO.
4551 Hamilton Avenue • Cleveland 14, Ohio

NEW PORTABLE SINGER SCREEN **PROTECTION ON ALL 4 SIDES**

NOW — a lightweight portable screen designed for complete enclosure. Easy, fast slip-joint assembly (no threads). Rust-proof finish. In 3 curtain materials:

JOHNS-MANVILLE ALUMINIZED ASBESTOS cloth — the last word in protection . . . neoprene-coated *FIBER GLASS* . . . 12 oz. fire-resistant *DUCK*. All sizes. Also available in single and three-sided models. Ask your dealer or write us.

16 PAGE CATALOG

Complete line of work gloves, welding gloves and safety clothing.

Special Products Division

SINGER GLOVE MFG. CO.

860 W. Weed St., CHICAGO 22, ILL.

SEE OUR AD IN WELDING DATA BOOK

Book Reviews

Radioisotopes

RADIOISOTOPES IN INDUSTRY (NYO-2977). National Industrial Conference Board, New York City, 1959. Price $2.75.

This survey, carried out under contract to the Atomic Energy Commission, covers the following general areas: census of radioisotope applications in industry; general techniques involved in specific industrial applications; possible methods as substitutes for radioisotope applications, approximate costs involved in preparing to use radioisotopes; savings in materials, labor costs, facility maintenance, and downtime for radioisotope use; possible increase in sales as result of new or improved products, and estimated value; and possible benefits from radioisotope use, such as improved research and development methods.

Aluminum alloys

TENTATIVE CODE FOR THE SELECTION OF WROUGHT ALUMINUM ALLOYS FOR SHIP STRUCTURES. Prepared and published by the Society of Naval Architects and Marine Engineers, New York City, 1959.

Prepared in accordance with the instructions of the publishing organization's Panel S-11, this code briefly sets forth aluminum selection standards in two parts: Part 1, covering heat-treatable alloys (sheet, plate, and shapes), and Part 2, covering specifications for grades "A" and "B" non-heat-treatable alloys. Six tables are included, indicating temper, thickness, tensile strength minimum and yield strength minimum in pounds per square inch, and elongation percentage in 2-in. minimum.

Metal photomicrography

PHOTOMICROGRAPHY OF METALS. Published by Eastman Kodak Co., Rochester, N. Y., 1959. Price $ .50.

This interesting, 44-page booklet covers the field of the photographic approach to metallography. It includes discussion of such areas as the design and function of the metallographic microscope, light filters, black-and-white and color sheet films, exposure determination, and processing and printing.

The reader is aided by a number of schematic drawings, charts, graphs, and illustrations.

braze, solder, preheat, hard surface tough-to-work metals

with *Arcair* **CARBON WELDING TORCH**

With this easy-to-handle torch, you can weld and braze metals that formerly required oxy-acetylene equipment. What's more, the Arcair Twin-Electrode Torch cuts costs on brazing, soldering, preheating and hard-surfacing operations. You step-up the usefulness and productivity of your electric welder.

The 9000 F arc produced between the twin electrodes assures sound, strong welds — with or without filler rods. Write today for free booklet.

Specify Arcair A/C welding carbons for a smoother, more stable arc . . . and coolest, most efficient operation.

THE *Arcair* COMPANY
427 S. Mt. Pleasant St. • Lancaster, Ohio

In 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding foundation—and

MORT CLARK'S **GALV-WELD** ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959 —23 YEARS LATER!

TIME PROVEN - MODESTLY PRICED WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

Mail Coupon Today

GALV-WELD PRODUCTS
Dept. WE — Box 1303 — Bradenton, Fla.
Send Information User ☐ Distributor ☐ Dealer ☐ Free Sample ☐
Name ..... Address .....
City ..... State .....

Free literature

. . . use card on page 107

75. WEATHERPROOF WELDER—National Cylinder Gas Div., Chemetron Corp. Bulletin NH-162 describes d-c arc welding units that are completely weatherproofed for use by ship builders, contractors, and metal fabricators.

76. AIR-COOLED HOLDER—J. B. Nottingham & Co., Inc. New data sheet pictures and describes firm's air-cooled electrode holder for heavy-duty metallic arc welding.

77. X-RAY EQUIPMENT — Mitchell Radiation Products Corp. Folder contains photographs, descriptions, and some specifications for company's line of x-ray machines and related equipment.

78. X-RAY APPLICATION — Phillips Electronic Instruments. Four-page reprint of article concerns applications of x-ray devices in the automotive industry, discusses research on copper, nickel and zinc alloys, relationship of crystal orientation to metal texture.

79. RESISTANT CASTINGS—International Nickel Co., Inc. Booklet, 64 pages and fully illustrated, is designed as an aid to those interested in stainless steel and high-alloy casting selection, design and production.

80. GAMMA RADIOGRAPHY—Radiation Engineered Services. Folder illustrates and lists specifications for various models of gamma radiography machines.

81. PORTABLE BLOWER—Manhattan Electric & Maintenance Co. Folder briefly describes firm's waterproof, vaporproof portable pressure blower.

82. WELDING HOSE—Swan Rubber Co. Literature details company's manufacturing facilities and complete line of industrial hose, including welding hose.

83. POWER SUPPLIES—Glenn Pacific Power Supply Corp. Features, applications and specifications of firm's constant voltage power supplies for precision welding are contained in four-page brochure.

84. USES OF CO_2—Pure Carbonic Co. New 24-page booklet (Form ADPC 41) on carbon dioxide and its value to industry covers history, principal applications, properties, manufacture, supply and distribution of CO_2 in gaseous, liquid, and solid form.

85. WELDING RODS—National Cylinder Gas Div., Chemetron Corp. Data sheets include specifications, welding and brazing characteristics, physical properties, and a color identification guide for welding filler rods.

86. CRYOGENIC EQUIPMENT—Standard Steel Corp. Illustrated booklet discusses firm's cryogenic equipment, including bulk storage vessels, truck transports, liquid pumps, and space vehicle fueling vessels.

87. SAFETY GOGGLES—American Optical Co. Flysheet describes chippers' and weldors' goggles, lists prices for quantity purchasing.

88. DUST MASK—Watchemoket Optical Co. Illustrated folder considers company's dust filter mask and associated equipment.

89. SAFETY HELMETS—Welsh Mfg. Co. Flysheet illustrates, in color, and describes, line of safety hats made of aluminum and fiberglass.

90. POWER SAWS—DoAll Co. Twelve-page color catalog depicts and describes line of power saws, including models intended for straight cut-off work and for mitering and angular work.

91. ATOMIC USE OF X-RAYS—Phillips Electronic Instruments. Four-page magazine article reprint describes work with x-ray diffraction, lattice parameter determinations in studies of the amount of alloy or solid solution, temperature effects on atomic spacing, and oxygen effects on zirconium.

92. STEEL WIRE—Jones & Laughlin Steel Corp. Technical data and practical information about using and ordering stainless steel wire are given in 22-page illustrated booklet.

93. MINIATURIZED CLAMPS—Detroit Stamping Co. Bulletin No. 102105 features series of miniaturized, vertical-handle toggle clamps and horizontal-handle "Tiny Toggles." Prices and complete specifications for each series are listed.

94. LIFTING TOOLS—James Campbell Smith, Inc. Folder explains and depicts applications of firm's clamping and lifting tools in rigging and handling problems.

95. SPOTWELDING TIPS—Air Reduction Sales Co. Catalog 1308 uses "RW" taper numbering system for specifying spotwelding tip size, shows new holders in straight, offset, close-coupled, and universal styles.

96. A-C/D-C WELDERS — National Cylinder Gas Div., Chemetron Corp. Four utility arc welders for use where a-c and d-c welding currents are needed, are described in two bulletins; welders designed for shop and garage use are covered in bulletin NH-176, models for shop and factory in bulletin NH-177.

97. AUTOMATIC TORCH — Prest-O-Matic Co., Inc. Four-page folder sets forth advantages of battery-ignited, automatic air-acetylene brazing torch with built-in self-lighting electric ignition system.

98. SAFETY LENSES—Watchemoket Optical Co., Inc. Bulletin 459 covers safety frames, lenses and other features of firm's safety glasses, including side shield models.

99. LIQUID FLUX—Rexarc, Inc. Company Form 659 describes use of liquid flux in brazing and welding operations, includes price list.

100. ALUMINUM PRODUCTS—Harvey Aluminum Technical brochure in 12 pages reviews full range of shapes, sizes, and alloys available in aluminum pig, ingot, and billet, includes metallurgical tables and design information.

101. ULTRASONIC CLEANING—Branson Ultrasonic Corp. Two-color, 23-page booklet thoroughly discusses solutions and chemicals for ultrasonic cleaning, cleaning transducers, generators, and ultrasonic system design and arrangements.

102. BRAZING MACHINES — Boyd Welding Co. Folder lists details on automatic brazing and soldering machines, including accessories and basic machine specifications.

103. RESISTANCE WELDER—Taylor-Winfield Corp. New 12-page brochure describes dial feed mechanism for resistance welders, includes drawings and photographs as well as graphs showing recommended rate of indexing for various numbers of stations.

104. INDUSTRIAL RADIATION — Picker X-Ray Corp. Use of gamma rays for nondestructive testing, including examples of current industrial applications of x-ray and radioisotope machines, are given in 12-page booklet.

105. PLUNGER CLAMPS — Detroit Stamping Co. Company bulletin No. 601606 features three new models of plunger-type toggle clamps added to standard line.

106. PARTICLE INSPECTION—Harry Miller Corp. Wet magnetic particle inspection using Immunol 438 in water as the vehicle for oil soluble and water-inspection pastes is subject of 36-page booklet.

107. MULTI-FIT BRIDGE — Fendall Co. Flysheet describes multi-fit eyelglass bridge, shows other components and cites figures indicating product is suited to 99% of workers.

108. PIERCING PRESS—Federal Machine and Welder Co. Sixteen-page brochure in color illustrates and describes line of piercing, notching and blanking presses in capacities from 100 to 800 tons.

109. SELENIUM RECTIFIERS—Miller Electric Mfg. Co. Design, manufacture, and characteristics of line of selenium rectifiers is treated in 12-page, three-color brochure, which includes graphs and illustrations.

114. HEAT INDICATORS—Tempil Corp. Newly revised data sheet provides instructions for determining temperatures in industrial applications, complete line of firm's temperature sticks.

115. ALUMINUM MANUAL—All-State Welding Alloys Co., Inc. A complete survey of aluminum welding, brazing, and soldering is included in a comprehensive 40-page illustrated manual.

116. PRESSURE REGULATORS—Watts Regulator Co. Catalog features a broad range of pressure regulators for application to air, steam, water, LP gas, acetylene, and some oils.

117. COMBUSTION FURNACES—Hevi-Duty Electric Co. Bulletin 659 contains complete information and specifications in detail on company's combustion tube furnaces.

118. WHEEL HOLDERS—Weldma Co. Two circulars illustrate and briefly describes firm's electrode wheel holders for resistance welding operations.

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CLASSIFIED EMPLOYMENT • BUSINESS • THE WELDING SHOPPER OPPORTUNITIES ADVERTISING • EQUIPMENT—USED and RESALE

UNDISPLAYED RATE

(Not available for equipment advertising) $1.10 a line, minimum 6 lines. To figure advance payment, count 5 average words as a line.

INDIVIDUAL EMPLOYMENT WANTED advertising rate is ½ the above rate; minimum $5, payable in advance.

INFORMATION

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DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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The advertising rate is $12.00 per inch for all advertising appearing on other than a contract basis. Maximum size of display ad is 4 col. in. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ in. vertically on one column, 3 columns — 30 inches — to a page.

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FOR SALE

Back injury forces sale of Prosperous Machine and Welding Shop in excellent location. Write Box No. 687 c/o Welding Engineer, 5826 Dempster St., Morton Grove, Ill.

SERVICES

Research & Design Service

High pressure gas data to 30,000 PSI Gas mixture Charts & Tables. Welding consultation & Design. P. O. Box 3072, Whittier, California.

WANTED TO BUY

WANTED TO BUY

Any type high pressure cylinder with or without valve. Please send details as to size, age etc. to

Connecticut Welder Supply Co.

600 Waterview Ave. Bridgeport 8, Conn.

EQUIPMENT FOR SALE

JEM PENETRAMETERS

X-Ray and Gamma-Ray

Prompt Delivery — All Codes

JEM PENETRAMETER MFG. CORP.

6 Huron Drive, Natick, Mass.

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ACORN

LAYOUT BLOCKS or WELDING PLATENS

ACORN IRON & SUPPLY CO.

901 N. Delaware Ave., Phila. 23, Pa.

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CUTTING MACHINES, AIRCO Camo & Radiagraphs and NATIONAL No. 5

CUTTING TORCHES, Used, Oxweld, Airco, Harris.

WELDING TORCHES, New, Rego GV.

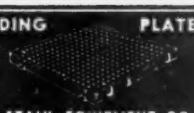
BRONZE—STAINLESS—AMPCOTRODES.

ELECTRODE HOLDERS.

WELDING EQUIPMENT BOUGHT & SOLD. All Kinds. Submit List and Prices.

RALL SUPPLY CO., 51 E. 42nd St., N.Y.C. 17

WELDING PLATENS



STAHL EQUIPMENT CO.

94 Washington St. Brookline 46, Mass.

AMBRAZE QUALITY BRAZING ALLOYS

Fully Guaranteed Materials Meets all Gov't, AWS, ASTM Specifications.

Low Fuming Bronze Rod—

Aluminum—Nickel Silver—

Silver Solder—Flux—

Phos Sil 0,2,6,15 Alloys

Write today for full details

AMERICAN BRAZING ALLOYS CORP.

P. O. Box 11 Pelham, N. Y.

WELDING CABLE

AT LOW PRICES

CUT-TO-LENGTH

#8	7½¢ ft.	#1	24¢ ft.
#6	9½¢ ft.	#1/0	29½¢ ft.
#4	12½¢ ft.	#2/0	36½¢ ft.
#3	15½¢ ft.	#3/0	46¢ ft.
#2	19½¢ ft.	#4/0	56¢ ft.

5% Discount For Full Reels of 500 ft. and 1000 ft.

We Pay Freight on 300# or More.

Add 10% For Orders Under 100 ft.

Call Universal for all Electric Wire and Cable Needs

Write for our 1960 Stock Sheet.

UNIVERSAL WIRE & CABLE CO.

2915 N. Paulina St., Chicago 13, Ill.

Phone: Eastgate 7-4777

SCHOOL

"UPGRADE" YOUR WELDING OPERATORS. Send them to Hobart's non-profit welding school. Specialized training for code tests and all phases of welding, manual and automatic. Newest and most completely equipped school in the country. Low tuition. Write Hobart Welding School, Box U-602, Troy, Ohio.

EQUIPMENT FOR SALE

LOW FUMING BRONZE RODS

for Gas Welding & Brazing

Bare & Flux Coated

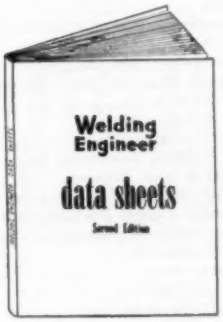
AUFHAUSER BROTHERS

Albertson, Long Island, New York

BOOKS

Bigger-Better — New 1960

. . . the 2nd edition is just off the press. Get your copy now . . .



This cross-indexed volume contains 126 of the best Data Sheets appearing in WELDING ENGINEER in the past 15 years. Yet it costs only $1.40!

See your welding supply distributor or use coupon below.

WELDING ENGINEER
P.O. Box 28, Morton Grove, Ill.

Please send me .....copies of the Welding Engineer Data Sheets. I enclose ☐ Check ☐ money order ☐ Bill me.

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Literature offered in ads

150. Alloy Rods Co. — Bulletin AR-21 further explains "Wear-O-Matic WH welding Wire."

151. All-State Welding Alloys Co., Inc.—Four complete tables covering temperature ranges from 400F to 800F is available; also instruction manual.

152. Alva Allen Industries—Catalog giving complete specifications and prices on Allen's heavy duty punch presses available.

153. Ansco, Div. of General Aniline & Film Corp.—Illustrated booklet of case histories where radiography and photography have helped increase business efficiency.

154. Ansco, Div. of General Aniline & Film Corp.—Further information available on "Superpak" X-ray films.

155. Anti-Borax Compound Co.—Descriptive circular and free sample of brazing flux available.

156. Arcair Co.—Booklet available on carbon welding torch manufactured by Arcair.

157. Auto Crane Co.—Illustrated literature, specifications and price list on all models of Auto Crane lifting and hoisting equipment.

158. Bastian-Blessing Co.—Information and specifications on "RegO" relief valves and safety relief devices.

159. Bateman Foundry & Machine—Complete information on the "Bantam Iron Worker" and name of your nearest distributor.

160. Bay State Abrasive Products Co.—For further information on grinding operations circle No. 160 on Info-Aid card.

161. Branson Instruments, Inc.—Bulletin T-200 on Ultrasonic flaw detection further explains the new "Sonoray" model 5 pulse-echo type instrument.

162. Budd Co. Electronic Controls Div.—Further details available on "Monautronic V-2" control for resistance welding.

163. Budd Co., Nuclear Systems Div.—Gamma Radiograph bulletin available.

164. Cam-Lok Div., Empire Products, Inc.—Bulletin No. 301 on receptacles and plugs.

165. Chicago Hardware Foundry Co.—Information on "Fuse-Well" cast iron welding rods and electrodes is available.

166. Clements Mfg. Co.—Write for further information on the "Cadillac" blowtorch, for all kinds of heat treating and production processes.

167. Columbia Electric Mfg. Co.—Illustrated catalog on "Tong Test AC-DC Ammeter."

168. Contour Sales Corp.—Further data available on "Curv-O-Mark" pipe layout tools for marking pipes and structural angle cuts of any type.

169. Curtiss-Wright Corp. — Write for further information on Curtiss-Wright nondestructive testing equipment and how it can help your particular operation.

170. Dockson Corp.—Catalog 56-06 on Dockson helmets is available.

171. Duro Engineering Co.—Further information available on "Duro" electrode holders.

172. E. I. du Pont de Nemours & Co.—Write for further information on "Du Pont Day Pack Roll Film" and other industrial x-ray products.

173. Eastman Kodak Co.—Further information on Kodak industrial X-Ray film type AA.

174. Eisler Engineering Co., Inc.—Catalog 92-57 on spot and wire butt welders and the vertical type press welder is available.

175. Eutectic Welding Alloys Corp.—Write for additional information on "QuenchTrode" welding, the new water cooled welding process.

176. Fibre-Metal Products Co.—Catalog No. 26 available on vulcanized "Fibre" welding helmets.

177. Galv-Weld Products—Information and distributor franchises on galvanized welding and samples are available.

178. General Cable Corp.—Further information available on welding cable manufactured by General Cable.

179. General Electric Co., X-Ray Dept.—Information on inspection problems and how they can be solved with G-E x-ray inspection equipment.

180. General Magnaplate Corp.—Write for further data on non-destructive testing with General Magnaplate testing equipment.

181. Gevaert Co. of America, Inc.—Booklet available, "Gevaert Industrial X-Ray Films."

182. H & M Pipe Beveling Machine Co.—Catalog sheets and price lists on the complete H&M line of cutting and beveling machines.

183. Handy & Harman—Bulletin 20 available giving you a good picture of silver brazing and its benefits, including details on heating methods and production techniques.

184. Harnischfeger Corp. — Further information on P&H welding positioners to help you cut welding costs.

185. Harrisburg Steel Co.—Additional information available on gas cylinders manufactured by Harrisburg.

186. Harris Calorific Co.—Write for further information on cutting torches manufactured by Harris.

187. Heath Engineering Co.—Further information on the Ultra-Graph guidance machine for application to flame cutting or welding.

188. Hobart Brothers Co.—Illustrated bulletin covering latest automatic welding process available.

189. Hobart Brothers Co.—Information and samples of Hobart No. 12 electrode.

190. International Nickel Co. — "Repair Cast Iron Parts Quickly and Easily" further explains the Hi-Rod "55" electrode story.

191. Jackson Products — Information on Jackson "Featherlight" holders available.

192. Lenco, Inc.—Booklet available, "Reducing Costs by Proper Care of Arc-Welding Circuits."

193. Lincoln Electric Co.—Additional data on Lincoln arc welding and how you can cut cost.

WELDING

INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 93 to 102

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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★ For copies of any manufacturers bulletins described on these pages circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card You need no postage.

★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 93.

WARNING!

Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

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Literature offered in ads . . . continued

194. **Linde Co.**—Write for additional information on Linde's torches for "Heliarc" welding.

195. **Markal Co.**—Literature and sample pellet of "Thermomelt" temperature indicators available.

196. **Merrill Brothers**—Catalog C-2 on large "G" clamp and other material handling devices.

197. **Metalloy Products Co.**—Testing sample of "Galvalloy" available for your galvanizing job.

198. **Mid-State Welder Mfg. Co.**—Further information available on silcon powered welders manufactured by Mid-State.

199. **Miller Electric Mfg. Co., Inc.** — Form No. BW-3 further explains the new Miller BWC-300MAP welder.

200. **Miller Electric Mfg. Co., Inc.** — Complete specifications on the new Miller constant potential D-C welder will be sent upon request.

201. **National Carbide Co.**—Further information available on calcium carbide and name of your nearest distributor.

202. **National Cylinder Gas, Div. of Chemetron Corp.** — Data sheets available on "Sureweld" electrodes.

203. **National Welding Equipment Co.**—Discriptive literature on regulators and torches and name of your nearest distributor.

204. **Page Steel & Wire Div.**—Folder containing information on submerged arc and inert gas welding wire and charts available; also name of your nearest Page distributor.

205. **Phelps Dodge Copper Products Corp.**—Information on "Habirprene" arc welding cable is available.

206. **Philips Electronic Instruments**—Additional information available on "Norelco" industrial x-ray equipment.

207. **Phoenix Products Company**—Folder available, "DryRod as Standard Welding Equipment."

208. **Picker X-Ray Corp.**—Write for solutions to radiographic inspection problems; also details of Picker's rental plan.

209. **Pressed Steel Tank Co.**—Prices and specifications on "Hackney" cylinders for compressed industrial gas.

210. **J. M. Ragle Industries**—Write for more information on the Commando drill kit for cleaning tips and other Commando products.

211. **Rankin Mfg. Co.**—Complete information on "Ranite" hardsurfacing rods and name of your nearest distributor.

212. **Ransome Co.**—Send for catalog and more data on Ransome "Job Fitted" positioning equipment.

213. **Ruemelin Mfg. Co.**—Write for detailed information on fume collectors manufactured by Ruemelin.

214. **Servospeed, Div. of Electro Devices, Inc.**—Data on electronic engineering with precise motor speed control.

215. **Shawinigan Products Corp.**—Write for further information on calcium carbide and name of your nearest distributor.

216. **Simonds Abrasive Co.**—Bulletin ESA 244 on Simonds new series 60 grinding wheels available.

217. **Singer Glove Mfg. Co.** — Catalog depicts complete line of work gloves, welding gloves and safety clothing.

218. **A. O. Smith Corp.**—Additional data available on the new A. O. Smith "MonArc" welding machine.

219. **Sperry Products, Inc.** — Write for further information on Sperry "Sonoflux" to help you with your weld inspection problem.

220. **Stulz-Sickles Co.**—Further information on repair and rebuilding with "Manganal" steel and name of your nearest distributor.

221. **Tec Torch Co., Inc.**—Write for additional data on Tec "Visuweld" water-cooled torches for tig welding.

222. **Tempil Corp.**—Further information on "Tempilstiks" the temperature indicating crayons.

223. **Tuffaloy, Div. of Air Reduction Sales Co.**—Further details on "Goldcrown" ejector holder available.

224. **Tweco Products, Inc.**—Information on "Twecotong" holders with ball-point cable connection and a cable connection support is available.

225. **Valvair Corp.**—Bulletin SVA-5 further explains the "Valvair" welding gun cap valve.

226. **Victor Equipment Co.**—Descriptive literature on Victor's rebuilding machines manufactured by L & B Welding, Inc. now a subsidiary of Victor.

227. **Victor Equipment Co.**—Write for additional information on "Ni-Mn" rods and a dealership for them and other Victor equipment.

228. **Webb Corp.**—Illustrated literature on tank production machinery manufactured by Webb.

229. **Welsh Mfg. Co.**—Write for further information on Welsh's new goggles for weldors.

230. **Westinghouse Electric Corp., X-Ray Dept.**—Further information on the "Baltospot" X-ray unit is available.

231. **Wilton Tool Mfg. Co., Inc.**—Write for further information on Wilton's C-Clamps.

232. **York Engineering Co.**—Additional information on York's "Spat-R-Pruf" compound, to eliminate spatter grinding after welding.

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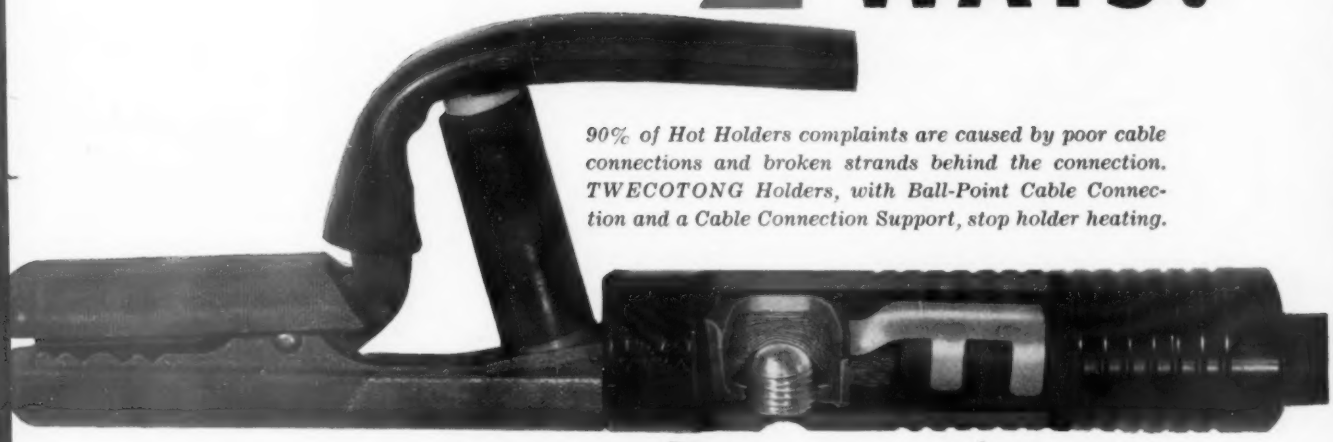

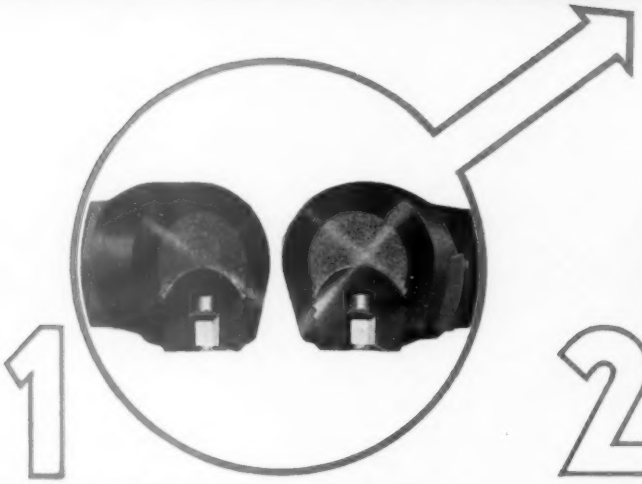

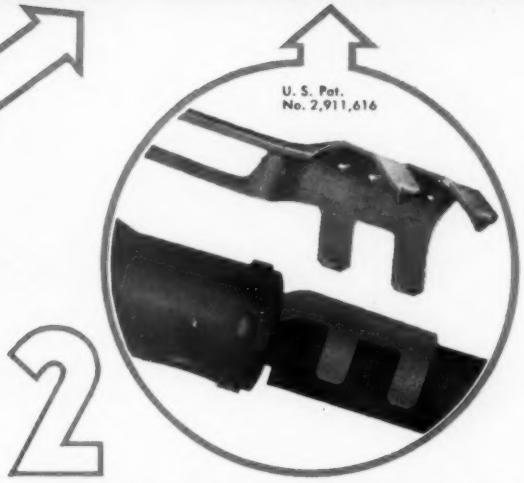

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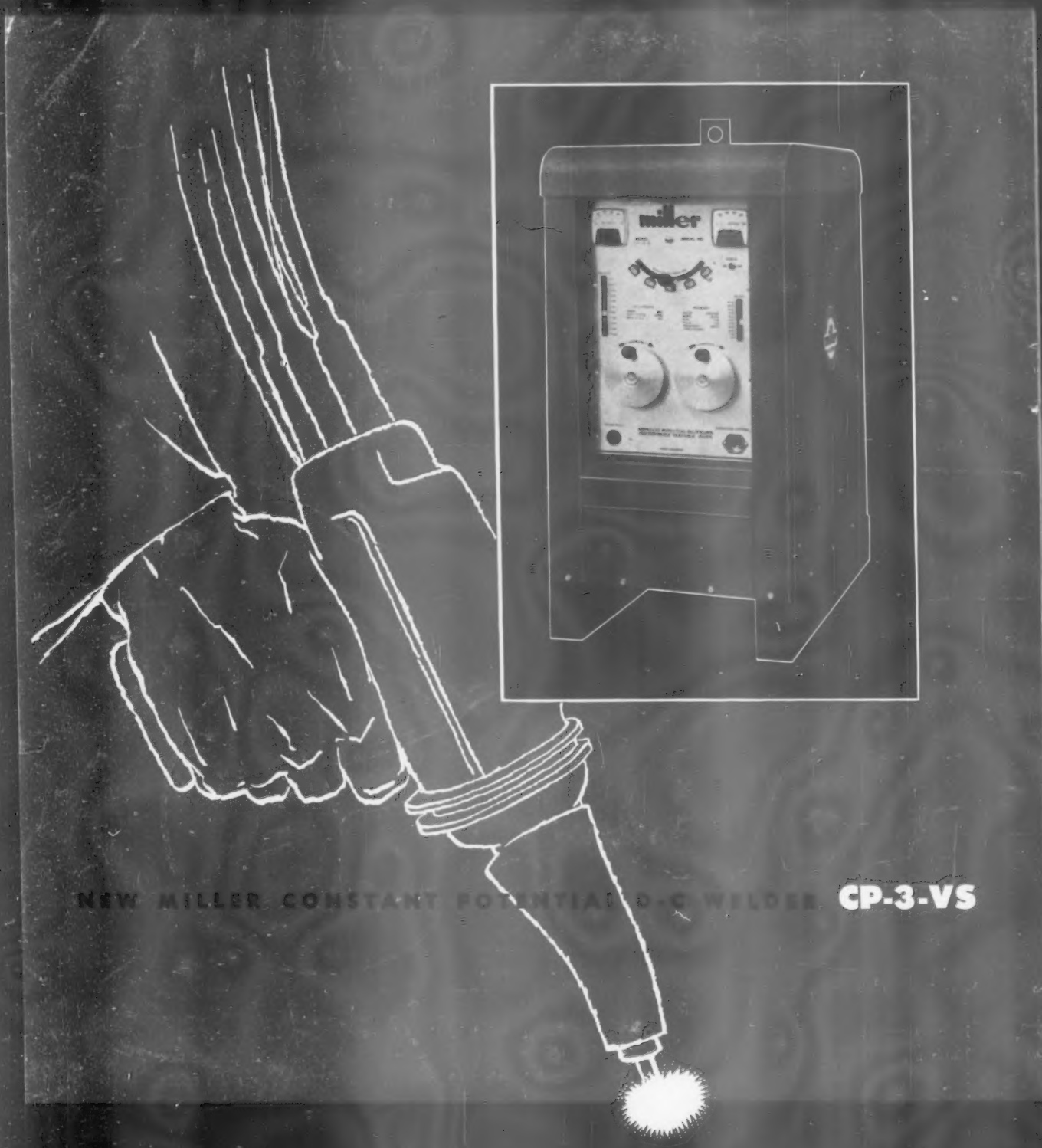

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